TECHNICAL GUIDE

CGAP

GETTING REPAID IN ASSET FINANCE

A Guide to Managing Credit Risk

June 2021

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Acknowledgements

The authors wish to thank the many experts and organizations without whose invaluable help this technical guide would not have been possible.

Dedicated professionals at asset finance companies around the world shared information, insights, and took the time to walk us through complex, sensitive areas of their businesses. Specifically we would like to thank Alison Boess and Andreas Thiele (Engie Energy Access); Simone Vaccari (PEG Africa); Jon Saunders and Henry Clarke (SunCulture); Gaurav Mehta, Rajeev Ranjan, and Sarah Keller (Dharma Life); Michael Wilkerson, Marisa Fee, and Rodney Schuster (Tugende), Alan Mathers (EFTA); Abderahmane Sow, Loïc Vervoort, and Thebean Gilfillian (Oolu); Victoria Arch, Jennifer Boughton, Priscilla Choi, and Peter Kunhardt (Angaza); Esther Altorfer and Graham Day (Sistema.bio); Loïc Deschamps and Caroline Frontigny (uPowa); Laura Palgrade and Thomas Samuel (Moon); George Mugenyi (Cosma Sustainable Rural Development); Kany Keita (Energy+ Mali); Russell Lyseight (Vitalite); Kate Steel and Madeleine Gleave (Nithio); Alexandre Galicier (d.light); Sarah Mijabi (Greenlight Planet); Dustin Kahler (M-KOPA); and Anthony Mabonga (Bboxx).

Dedicated risk management experts opened themselves up to new learnings and ideas in order to make this work happen. From Frankfurt School we would like to thank Dr. Joachim Bald, Basel Chaban, Natalia Carranza, and Christian Kuye. From IPC we must thank Isaac Williams, Clementine Hedan, Sathya Krithivasan, Rui Chikande, and Alaa Nasser. In addition, energy access and asset finance experts contributed key insights at various stages of the report, including Kevin Kennedy, Tamara Cook, Adrian Bock, Leslie Labruto, Geoff Manley, Leo Blyth, Buddy Buruku, Jamie Anderson, Michael Franz, Peter Storey, Simon Brossard, and Kat Harrison. Our own colleagues provided invaluable contributions: Nicky Khaki, Sai Kumaraswamy, Xavier Faz, Alexander Sotiriou, Juan Carlos Izaguirre, and Estelle Lahaye. Lastly, this research would never have been possible without the work and cooperation of the Global Off-Grid Lighting Association (GOGLA) and the Global Distributors Collective (GDC). We would like to especially thank Drew Corbyn, Rebecca Rhodes, and Roan Borst at GOGLA; and Emma Colenbrander and Charlotte Taylor at the GDC.

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Cover photo: Temilade Adelaja via Communication for Development Ltd.

RIGHTS AND PERMISSIONS

ACRONYMS

AFC	Asset Finance Company
CDU	Consecutive Days Unpaid
CR	Collection Rate
EaD	Exposure at Default
EL	Expected Loss
KRI	Key Risk Indicator
KYC	Know Your Customer
LGD	Loss Given Default
MFI	Microfinance Institution
MIS	Management Information System
NPV	Net Present Value
PAR	Portfolio at Risk
PAYGo	Pay As You Go
RAR	Receivables at Risk
RAR(CDU)	Receivables at Risk (Consecutive Days Unpaid)
RAR(CR)	Receivables at Risk (Collection Rate)
PD	Probability of Default
RMC	Risk Management Committee
SHS	Solar Home System
TA	Technical Assistance

CONTENTS

INTRODUCTION

ASSET FINANCE ALLOWS PEOPLE TO obtain the physical items they need to generate money, save time, reduce drudgery, and improve their lives. From Sub-Saharan Africa to the Indian Subcontinent, asset finance and leasing companies are doing invaluable, innovative work to finance critical assets for low-income and informal borrowers.[1] But unlike banks and microfinance institutions (MFIs), many of these companies do not have deep experience in organizing a credit operation, mitigating risk throughout a credit transaction or managing a portfolio of loans or leases. This has important implications for the ability of asset finance companies (AFCs) to achieve financial sustainability: poor credit risk management will prevent them from turning receivables into cash, inhibiting their potential scale.[2]

Recognizing the need for more professional credit risk management in asset finance, CGAP provided technical assistance (TA) on credit risk management to more than 15 AFCs in Sub-Saharan Africa and Asia between 2018 and 2020. This TA, provided in collaboration with the Frankfurt School of Finance and Management and IPC GmbH, came in two parts. *First* was a diagnostic of the companies' credit risk management governance, policies, and practices: what was effective, ineffective, or absent. We laid out a set of recommendations for each company. *Second* was assistance in implementing the most pressing recommendations. These included training senior management on how to build risk management and audit departments, teaching credit scoring methodology, developing credit scorecards, and assisting in implementing portfolio analytics such as vintage analysis and transition matrices.

This guide summarizes the lessons learned from those engagements and offers executives and managers at AFCs suggestions on how they can manage credit risk while growing their operations. Investors and other sector stakeholders may also find this guide useful to inform their own due diligence and TA.

Chapter 1 offers a definition of the types of asset finance business models addressed by this guide and discusses the importance of credit risk management to asset finance and the barriers to credit risk management in the sector. **Chapter 2** describes the necessary infrastructure for credit risk management within an organization. **Chapter 3** covers the design of an asset finance product. **Chapter 4** goes through the steps of a credit transaction and discusses how risk can be mitigated throughout the process. **Chapter 5** dives into the management of a credit portfolio, including the analytical frameworks that managers will need in order to identify and mitigate risk.

1 For more on CGAP's global review of asset finance business models, see https://www.cgap.org/research/slide-deck/innovations-asset-finance

2 Throughout the paper, 'AFC' refers to an asset finance company operating in emerging markets in Sub-Saharan Africa or Asia, with at least a partial focus on serving low-income customers.

CHAPTER 1

ASSET FINANCE AND CREDIT RISK MANAGEMENT FOR LOW-INCOME CONSUMERS

PHYSICAL ASSETS—WHICH IN THIS guide refer to tangible items such as vehicles, smartphones, productive equipment, and more—have been shown to help low-income customers improve their productivity, increase their incomes and enhance the quality of their lives (Kumaraswamy et al. 2020).

But how do poor households acquire assets? In a country like Uganda, where 70 percent of the people live on less than $3.20 a day (World Bank 2020), few households can afford the upfront cost of a smartphone in cash, let alone something more expensive like a motorcycle. To acquire these assets, they need to be able to spread the payments out over time. Practically, this means either saving up the money to buy something or acquiring it and paying for it over time, plus interest (Rutherford 1999).

In this guide, 'asset finance' refers to the latter: loans or leases that allow a borrower to use a physical asset while they pay for it. In this type of finance borrowers usually do not pledge additional collateral; the asset itself can be repossessed in the event of default. Ownership is typically transferred to the borrower/lessor at some point in the transaction.[3]

Importantly, this guide specifically covers asset finance businesses that target low-income customers. Innovations

SUMMARY

- 'Asset finance' refers to loans or leases that allow a borrower to use a physical asset while paying for it over time.
- 'Credit risk' is the potential loss that may occur if one or more borrowers fails to make agreed-upon payments to their lender. In asset finance, this risk is increasingly being borne by the makers or distributors of the physical assets.
- Managing credit risk is essential for (a) achieving financial sustainability for providers, (b) maintaining affordability for customers, and (c) ensuring economic development.
- Asset finance faces unique challenges in effectively managing risk: (i) it caters to low-income, informal customers, (ii) it needs incentives to grow sales at the investor, provider and agent level, and (iii) it lacks traditional risk management structures. But these can be addressed!

3 Asset-backed loans and financial leases transfer legal ownership of the asset at different points, but they are similar enough to be covered together in this guide. Companies using operating leases may also find this guide useful.

TABLE 1. **Main business models encountered**[a]

	Pay As You Go (PAYGo)	Lease[b]
Asset Types	Smartphones, Cookstoves, Solar Home Systems (SHS), Televisions, Refrigerators	Motorcycles, Three-Wheelers, Solar Water Pumps, Biodigesters, Larger SHS
Price Range	$50 – $500	$400 – $2,500
Loan Tenors	3 – 36 months	12 – 42+ months
Repayment Schedule	Flexible, although unit is deactivated for missed payments	Fixed, payments required on-time monthly
Average Risk Profile	Relatively higher default levels	Relatively lower default levels
Credit Assessment	Upfront deposit required. Data often limited to Know Your Customer (KYC) information	References and guarantors required, payment capacity assessed, detailed questionnaire
Credit Risk Mitigation	Lockout technology, call center follow-up on delinquents, attempt to price in expected credit losses	Thorough assessment, stricter collections, relatively faster repossession, ability to recover value from repossessed assets

a The choice of lending model comes down to the nature of the asset and client type. Companies financing smaller assets or serving more remote customers often adopted PAYGo approaches; companies financing larger assets within tighter value chains (e.g., solar water pumps for cash crop farmers with a dedicated offtaker) or denser areas often opted for hire purchase.

b The term 'lease' represents two main business models here (hire purchase and financial leasing). In both of them, ownership remains with the lessor/vendor of the asset until all repayments are made, at which point ownership transfers to the payor.

in business models and new technologies have enabled asset finance to expand beyond its traditional focus on more affluent consumers and firms. And while there are many similarities to both more established asset finance and retail finance, financing assets for low-income customers entails unfamiliar risks which require a tailored approach to manage.

Overall, the business models covered by this guide tend to fall on a spectrum between PAYGo consumer financing for small assets and finance leasing (or hire purchase) for larger asset types. These types are compared in Table 1, although many businesses fall somewhere between the two.

1.1 Credit Risk in Asset Finance

Because reliable, high-quality assets are expensive, the demand for asset financing is high. Yet in low-income countries that demand remains largely unmet. In Sub-Saharan Africa, for example, just one in three households owns a television, one in six owns a refrigerator (Efficiency for Access Coalition 2019), and one in nine owns a computer (ITU 2020).

Asset finance for poor households entails a number of serious risks for companies (which is one reason why the sector remains underdeveloped). Assets may break, currency values may fluctuate, rains may fail, capital may dry up, and regulations may change. Some of these risks can be anticipated and planned for. Others, as the COVID-19 pandemic made abundantly clear, cannot.

This guide focuses on one type of risk in asset finance: *credit risk*.[4] Whenever a customer is given an asset *now* and promises to pay for it *later,* it is possible they will not fulfill that promise. That possibility, multiplied thousands or millions of times across a portfolio, is credit risk: the potential losses that may occur if one or more borrowers fails to make agreed-upon payments to their lender. Not all AFCs consider themselves creditors; many are not

4 It will become clear that credit risk is inextricably linked to other risk factors, such as operational risk, reputational risk, interest rate risk, asset liability management, and others. None of these can be looked at in a silo. Our main focus throughout is on credit risk, but we will touch on others when appropriate.

regulated financial institutions and may operate more like retail companies that allow customers to pay over time. However, the basic principle of credit risk (an expected payment that may or may not be received) is a feature of any business putting products in the hands of customers in exchange for a promise of future payment.[5]

LENDING TO POOR HOUSEHOLDS: WHO TAKES THE RISK?

For asset ownership to grow in lower-income countries—where many customers cannot afford to purchase important assets upfront—someone must take on the credit risk of lending to poor borrowers working in the informal economy. But who?

Partnerships between asset retailers and financial institutions, for whom credit is a core competency, have achieved modest success at best. Commercial banks in many low-income countries do not directly lend to households engaged in the informal economy (Srinivas 2016; Bruhn and Love 2009), which excludes much, if not most, of the population. MFIs lend to exactly these types of borrowers, but their procedures and skillsets are often ill-suited to financing physical assets (Waldron et al. 2019). Relying on financial institutions to provide financing therefore risks excluding many potential customers, with negative implications for impact and revenue.

This has led some companies targeting low-income customers—manufacturers and distributors of vehicles, solar home systems (SHS), smartphones, and other assets—to finance their sales on their own balance sheet, taking the credit risk on themselves.[6] This has broadly been a positive development: credit risk creates incentives to distribute high-quality assets and provide quality after-sales service. In doing so, AFCs are often building the first formal financial relationships that their customers have ever had, contributing to their financial inclusion and enabling their access to further financing for important needs like working capital, school fees and more. It is AFCs who are assessing potential customers, making credit decisions, and financing sales on their own balance sheets. However, many of these companies are new to the business of lending and do not have experience in managing credit risk.

WHY IS CREDIT RISK MANAGEMENT IMPORTANT?

Credit risk management is at the heart of successful asset finance for three reasons:

1. **Provider financial sustainability**. If an organization is unable to manage its credit risk (i.e., it is unable to turn contractual receivables into actual cash at its expected rate), then it will underperform financially and struggle to raise debt, eventually becoming illiquid and then insolvent. If this happens across enough companies then the sector's risk profile will rise, making capital more expensive.
2. **Customer affordability**. If a company is pricing-in expected credit losses (as it should be, see Chapter 3 and Chapter 5), then every customer that defaults on an asset loan/lease beyond the expected level makes that same asset more expensive for the next group of customers. If companies can minimize defaults through better assessment, monitoring or collections, they will be making their assets more affordable (see Box 1 for an example).
3. **Market development**. Low-income households need access to assets. But CGAP's experience working with AFCs shows that a failure to manage credit risk can push companies to consider shifting more of their lending toward higher-income customers and higher-value assets. Therefore, every time a lender tries and fails to serve low-income clients, they risk making it harder for those clients to access the things they need. It may be that some people are not financially

5 Note that credit risk is the *possibility* of nonpayment. Once a customer has been determined (contractually or otherwise) to have failed to pay, the risk has materialized and is now a *credit event* (usually referred to as a default). The determination of default is subjective; different companies can and do have very different policies towards determining default.

6 This type of credit has a long history; manufacturers and retailers have formed an important part of the formal financial ecosystem since at least the 19th century, and the informal one long before that (Calder 1999; Fleming 2018). Retailers with in-store banks in Latin America (financing consumer durables), mobile network operators (financing smartphones), and manufacturer-owed auto finance companies are some of the largest lenders to lower-income households.

viable customers for some assets.[7] But if the failure were addressable, for example if it were the predictable result of poor risk management, then this would represent a lost opportunity for companies, and for households that need every opportunity they can get.

BOX 1. **Illustrating the importance of credit risk management**[a]

A hypothetical case: A fictional PAYGo solar company in Kenya (we'll call it SolarCredit) disburses 12-months loans, each worth 1,000 Kenyan Shillings (KSH). Let the annual interest rate be 10%, so the expected payment after 12 months would be KSH 1,100 per loan/lease contract. If one of the loans goes bad immediately (i.e., the borrower does not make a single payment), how many "good" loans would SolarCredit need to make to cover that loss?

In this example, the company would need to earn the interest on ten good contracts each of them earning KSH 100, a total of KSH 1,000, to compensate for the loss. In other words, avoiding one bad contract is as valuable as disbursing ten good ones. This reality underscores the importance of effective credit assessment and scoring.

a Look for ongoing mention of fictional company SolarCredit in dark grey boxes throughout this guide.

1.2 Key Challenges to Managing Credit Risk in Asset Finance

Despite the clear importance of credit risk management and mitigation, structural aspects of asset finance make it harder for AFCs to prioritize and operationalize risk management, particularly in their early growth stages.

AFCS ARE FINANCING ASSETS FOR A RISKY GROUP OF CUSTOMERS: POOR HOUSEHOLDS WORKING IN THE INFORMAL ECONOMY

About 80 percent of Sub-Saharan Africa's economic output comes from the informal sector. So does half of India's economy, where the informal sector also employs 83 percent of its workforce (Murthy 2019). These are hundreds of millions of people who work desperately hard to provide for themselves and their families. But the informality of that work is a significant barrier for formal lenders. Without proof of formal employment or cashflow records for a microenterprise, lenders cannot be reasonably assured that borrowers have the capacity to repay a loan. To complicate matters further, borrowers in the informal sector face a greater set of risks: their incomes are often less regular and their employment less reliable than contracted employees. And security for lenders is hard to come by: collateral in the form of small household assets is costly and difficult to repossess.

MFIs have sought to bridge these gaps using tools such as group liability, references and guarantors, in addition to detailed in-person cashflow assessments.[8] But in many cases AFCs are trying to serve an even poorer customer base, requiring them to adopt some tools from microfinance, adapt others and even add a few of their own. These include:

- Remote lockout technology that reduces the risk of theft and expands the realm of possibilities for nonpayment contract clauses beyond simple repossession. Remote lockout can also enable flexible financing terms, which adhere more closely to the lumpy income patterns of many informal sector jobs.
- Remote-sensing and location devices that facilitate repossession and mitigate against unauthorized use of an asset.
- Digital payments, automated loan-management software, and well-trained call centers that keep costs low by allowing large portfolios to be serviced by relatively few staff.

7 Indeed, subsidies have an important role to play in reducing the cost of critical assets for low-income households.

8 Unlike AFCs, MFIs have historically lent exclusively to micro and small enterprises or financed productive ventures. They have not traditionally financed household or consumer assets, although companies such as Inthree Access in India are beginning to change that.

- Use of the asset itself as collateral, eliminating the need for borrowers to pledge an existing asset, such as their house or land, which many customers may not own or have a formal title to.

By combining these and other attributes, AFCs have been able to significantly reduce the risk of lending to low-income households. Although greater investment in formal risk management is still needed (see below), these concerns are only relevant because of innovation on the part of AFCs that has overcome some traditional barriers to financing-excluded customers.

INCENTIVES THROUGHOUT THE VALUE CHAIN REMAIN OVERLY SKEWED TOWARD SALES GROWTH

Any company with assets wants to sell them. Social enterprises, whose assets can change people's lives, *really* want to sell them. Social impact investors, who have placed equity or debt investments in these companies, also want them to make sales because sales are what create the impact. And in most cases, incentive structures reward agents or staff responsible for sales with a commission only when a sale is made, even though there may be higher rewards for 'quality' sales.

Taken individually, all of these incentives are understandable. Taken collectively, they form a powerful push toward growth, at multiple levels of the business. James Grant, a financial journalist, wrote in *Money of the Mind* that "growth at an exceptional rate is a red flag in banking…If loans are expanding too quickly, the lending officers have probably been saying 'yes' too frequently." Unless the appropriate risk management structures are in place, the combination of social and financial incentives can lead toward growth that is unsustainable.

What does unsustainable growth look like? (See Box 2 for examples.) For lenders to grow, they need to originate more loans or leases. This growth can come from (a) increasing sales at existing branches and agents, (b) by adding new locations and personnel, or (c) both. When growth is expected from existing areas, loans are often

BOX 2. Growth and credit risk in microfinance

In the mid-2000s microfinance was viewed as a for-profit mechanism for eradicating poverty, and MFIs began attracting significant investment from development finance institutions and private equity firms. These investors were aware of the potential for this growth to cause a decline in portfolio health but were able to point toward resilient asset quality as a sign that their investments were catalytic, not distortionary. An industry survey conducted in 2007 ranked 'credit risk' as only the tenth highest risk to the microfinance sector (Lascelles 2008).

Investment came with expectations of rapid growth, with the hope of bringing the benefits of microfinance to more and more people. But the institutions did not always have the systems or culture in place to manage risk while doubling or quadrupling their loan volumes. Reille and Forster (2008) wrote: "In many places, the debt market is overheated, and pricing does not reflect credit and country risks." Chen et al. (2010) noted that "target-driven, high growth can tempt MFIs to relax their lending discipline to reach volume and increase credit risk." In the same paper, one MFI investor was quoted as saying "These MFIs were growing so rapidly, they didn't have time to put proper risk management in place, and they didn't see the downturn coming."

The 2008 financial recession caused or coincided with repayment crises in Bosnia and Herzegovina, Morocco, Nicaragua, and Pakistan, among others. By 2009 'credit risk' had soared to become the number one perceived danger in the MFI sector (Lascelles and Mendelson 2009). In 2010, a complex combination of market factors and local politics converged in Andhra Pradesh, where excessive lending and misaligned incentives within leading MFIs (some of which had received significant external funding) led to abusive collection practices, which in turn led to an epidemic of farmer suicides. In the end, most MFIs were forced to write off the majority of their Andhra Pradesh portfolios; SKS Microfinance alone wrote off loans totaling almost $200 million (Menon 2016).

given to more marginal borrowers, whose ability or willingness to pay may be sub-optimal. When growth is expected from new areas, the organization must onboard new personnel while maintaining its culture and standards. If the rate of growth is too fast it can lead to poor underwriting, a deteriorating risk culture and a lack of supervision.

This is the social impact credit trap (Waldron 2021), and it is a familiar one. Similar waves of social investment have led to crises of repayment and consumer intimidation in both microfinance and digital credit (Izaguirre et al. 2018; Faux 2020). Whether the same pattern will be repeated in asset finance remains to be seen, but recent parallels bear watching.

ASSET FINANCE COMPANIES WITHOUT CREDIT EXPERIENCE OFTEN LACK THE STRUCTURES AND PROCESSES TO MANAGE CREDIT RISK

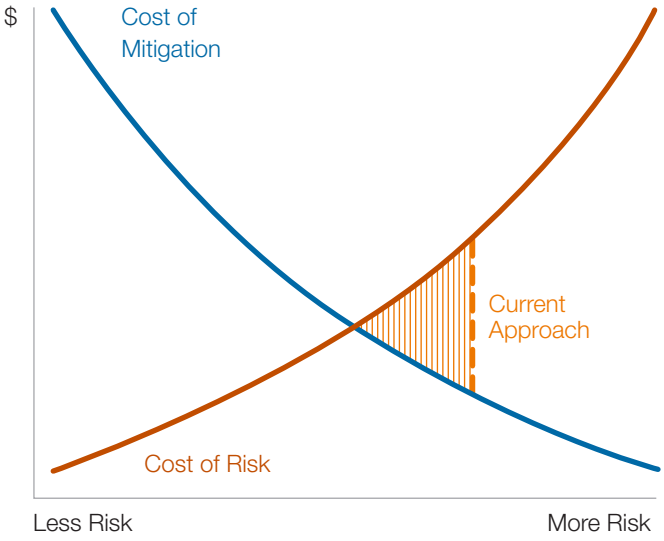
There is no one way to manage risk. Some lenders may prefer to lend only to high-quality borrowers. Others may wish to be more aggressive and price-in higher expected loan losses. Neither of these approaches is inherently wrong or right. But more aggressive approaches toward risk-taking require more robust systems in place to manage that risk. "A bank driven to achieve aggressive growth targets may require more detailed credit policies and more controlling administrative and monitoring systems to manage credit risk properly. Consistently successful banks achieve a balance between asset quality, growth, and earnings. They have cultural values, credit policies, and processes that reinforce each other and that are clearly communicated, well understood, and carefully followed." (OCC 1998)

That is not what we see in the emerging market asset financing sector, where risk management is often treated as a technical exercise, as opposed to an issue of culture and governance. Many companies in this sector prioritize reaching scale—particularly those financing high-volume, low-cost consumer assets—and are naturally aggressive in their lending practices. Yet many are also relying on a mechanical approach to risk management, focusing on the 'tools' (lockout technology, pricing adjustments, agent commissions, etc.) as opposed to the 'toolbox' (articulated risk appetites and loan limits, detailed credit policies, established processes, and independent risk control). Yet these are the foundations of risk management and are absolutely required to sustain this kind of lending.

The results are predictable: repayment rates are below expectations for many companies. Not all companies provision their expected losses (EL) fully or appropriately. Data is gathered haphazardly and stored in ways that make it difficult to analyze. EL are not always properly calculated, and are often not sufficiently priced in.

As described above, many of these firms began life as retailers, distributors or manufacturers, and so do not have the requisite expertise in managing credit operations. These companies have not compensated by investing in their risk management, and their cost of risk is likely higher than necessary (see Figure 1). That excess risk is either passed on to their customers (making their products more expensive) or to their shareholders (making the company and sector less viable). Yet this is correctable, if companies take reasonable steps to effectively manage credit risk.

FIGURE 1. **Balancing the costs of risk and risk mitigation**



CHAPTER 2
THE ORGANIZATION

IN TRADITIONAL FINANCIAL institutions—where risk-taking is a fundamental part of the business—corporate governance, independent risk management, and internal control work together to make sure that risks are managed, mitigated, or avoided in line with the institution's strategy.[9] Although AFCs do not face the same regulatory scrutiny as these financial institutions, the complexity of some of their business models, the challenging environments they operate in, and the volatility of their customers' incomes makes risk management just as, if not more, important to their success and survival.[10]

As mentioned in Chapter 1, CGAP's work with providers reveals that while various risk management tools can be powerful and useful, they need to operate within a strong culture and sturdy framework for managing risk (the toolbox) to be effective.

This chapter explores in turn the elements present in Figure 2: strategy, culture, governance, information systems, policies, and implementation that enable effective risk management. Not all of these frameworks will be feasible (or even reasonable) for early-stage companies to adopt, so the end of the chapter also provides rough guidelines on what the timeline of adoption ought to look like for an AFC. That said, all AFCs should have the fundamentals of credit risk management: a clearly expressed strategy for managing risk that is understood and embedded at every level of the organization.

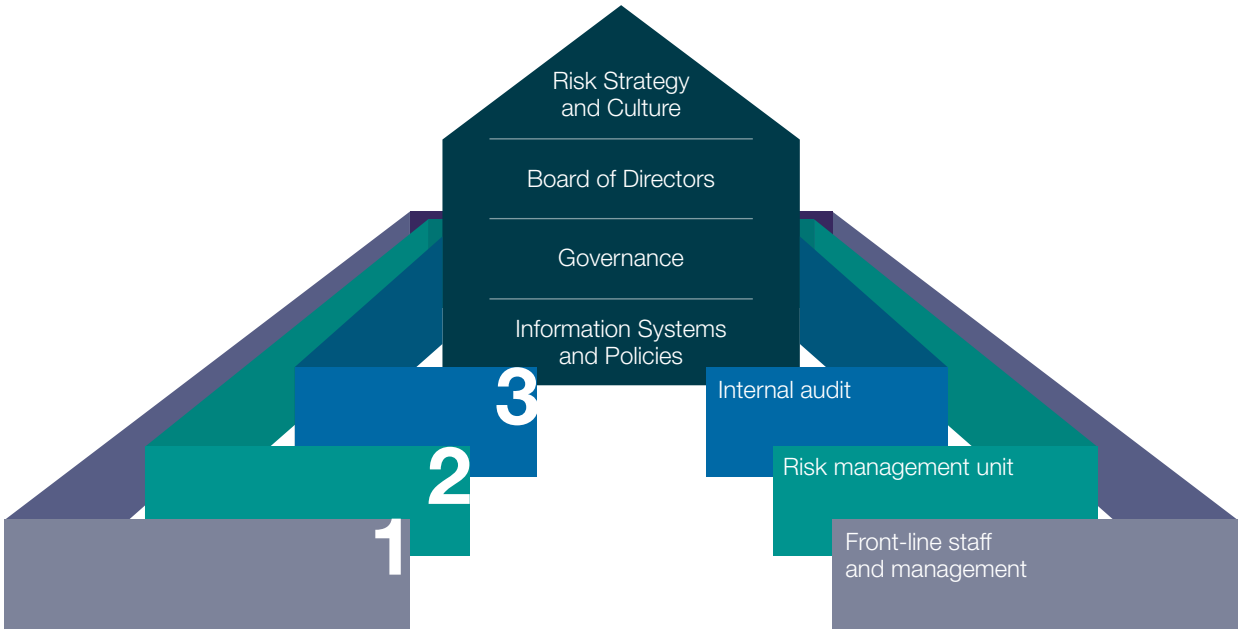
SUMMARY

- AFCs need to have a well-articulated risk management strategy and risk appetite. This will set the boundaries for how much risk the credit operation can incur.
- A 'risk culture' is set by a company's executives. It should demonstrate that risk management is a priority at every level of the business.
- The Three Lines of Defense, together with the Board Risk Management Committee (RMC), ensure that the risk management strategy and policies are abided by. This management information system (MIS) enables monitoring and oversight of credit transactions and portfolio.
- A policy framework is important to formalize the company's risk management procedures, but companies need to conduct interactive, participatory training to achieve understanding.
- Companies can build out their risk management infrastructure as they grow, but certain key elements should be present from the beginning.

9 Although originally designed for banks, Principles 14 and 15 in the 2012 BCBS "Core Principles for Effective Banking Supervision" as well as the 2015 BCBS "Corporate Governance Principles for Banks" describe current best practices in the governance of risk in financial services more generally.

10 See Sotiriou et al. (2018)

FIGURE 2: **Organizational elements of risk management**



2.1 Risk Management Strategy and Risk Appetite

The first step in risk management is developing a plan for identifying new risks, mitigating known risks, and regularly reviewing the organization's approach. This plan is the **organization's risk management strategy.** The core components of that strategy are (a) the policies and processes around risk-taking activities (addressed later in this chapter), and (b) the risk appetite statement, which is then translated into quantitative targets through risk capacity, tolerance, targets, and limits.

RISK APPETITE

A company's **risk appetite** is the nature and amount of risk that it is prepared to accept, tolerate or be exposed to at any point in time while pursuing its business model. The initial choice of business strategy implies a certain risk appetite, but the **risk appetite statement** formalizes it by defining the types and magnitude of risk that the company is willing to accept, or chooses to avoid, in order to achieve its objectives. The risk appetite should align with the company's mission and strategy: we might expect a company whose mission is to finance small-scale assets for low-income farmers, for example, to have a high appetite for credit risk. The statement should consider all risk dimensions that may significantly impact operations, as well as potential reputational damage to the company and its stakeholders, **and be consistent with the company's capacity to manage risk**. It should be approved by the board of directors and well disseminated throughout the company, especially for frontline staff and agents. (A sample risk appetite can be found in Annex 1, as well as in IRM (2017), Deloitte (2014), and Batty et al. (n.d.), among others.)

The risk appetite should lay out each of the following (indicative examples using fictional company SolarCredit *in italics).*

1. **Risk capacity** is the maximum risk that an organization is able to take regarding a certain risk.

   -SolarCredit can only continue functioning if early defaults (within the first 90 days) stay below 5 percent.

2. **Risk tolerance** is the maximum risk that an organization is willing to take regarding a certain risk. This tolerance is defined through quantified risk measures of risk exposure.

   -SolarCredit is willing to tolerate 2 percent early defaults for each monthly cohort.

3. **Risk targets** are the optimal levels of risk exposure that a company wants to take.

   -SolarCredit is targeting early defaults of 1 percent.

4. **Risk limits** are thresholds set by an organization on actual risk exposure. These are based on risk targets, and trigger automatic warnings and reviews if they are breached.

   -Based on its risk target, SolarCredit sets a limit on early defaults of 1.25 percent. If breached, this requires an immediate meeting of the executive credit committee, and the board RMC is to be notified.

In practice, many AFCs do not have a clearly articulated credit risk appetite. Risk is often managed through assumptions on losses, which are fed into pricing models and revenue projections. These targets are not always (or in some companies, even often) hit.

One of the clearest takeaways from our work is the need for AFCs to better articulate both the amount and nature of risk they wish to take on, and how that risk will be managed. They can then structure their operations, reporting and culture to consistently meet that statement.

2.2 Risk Culture

The blunt truth is that none of the frameworks, principles or tools described in this guide will make a difference unless everyone in the company, from the leadership down, believes that managing risk is important and should be taken seriously. To quote one risk manager: "Effective risk management doesn't function in a vacuum and rarely survives a leadership failure" (DeLoach 2015). This awareness of risk and accountability for managing it across the entire organization is often referred to as a 'Risk Culture'.

In our experience, AFCs in low-income countries tend to be founded and staffed by people who embrace risk. This ethos of risk-taking, experimentation and rapid iteration is critical in building businesses that can operate in remote settings with limited infrastructure, serving low-income households. However, this same spirit can create problems for a finance company that must place some limits on its risk-taking.

This is not to say that AFCs should avoid credit risk; the only way to do that is to stop lending altogether. But it is the job of a credit operation to evaluate potential risks and determine whether they can be taken on and mitigated, or should be avoided altogether. If the sales department is the gas pedal on a car, then the credit department is the speedometer, and (if needed) the brake. A good risk culture involves acknowledging that the company has an appropriate 'speed' to run at, and that risk management is crucial to maintaining that speed.

Practically speaking, a risk culture is determined by the actions of leadership, emulated by managers and regularly communicated and demonstrated to staff and agents at all levels. It includes:

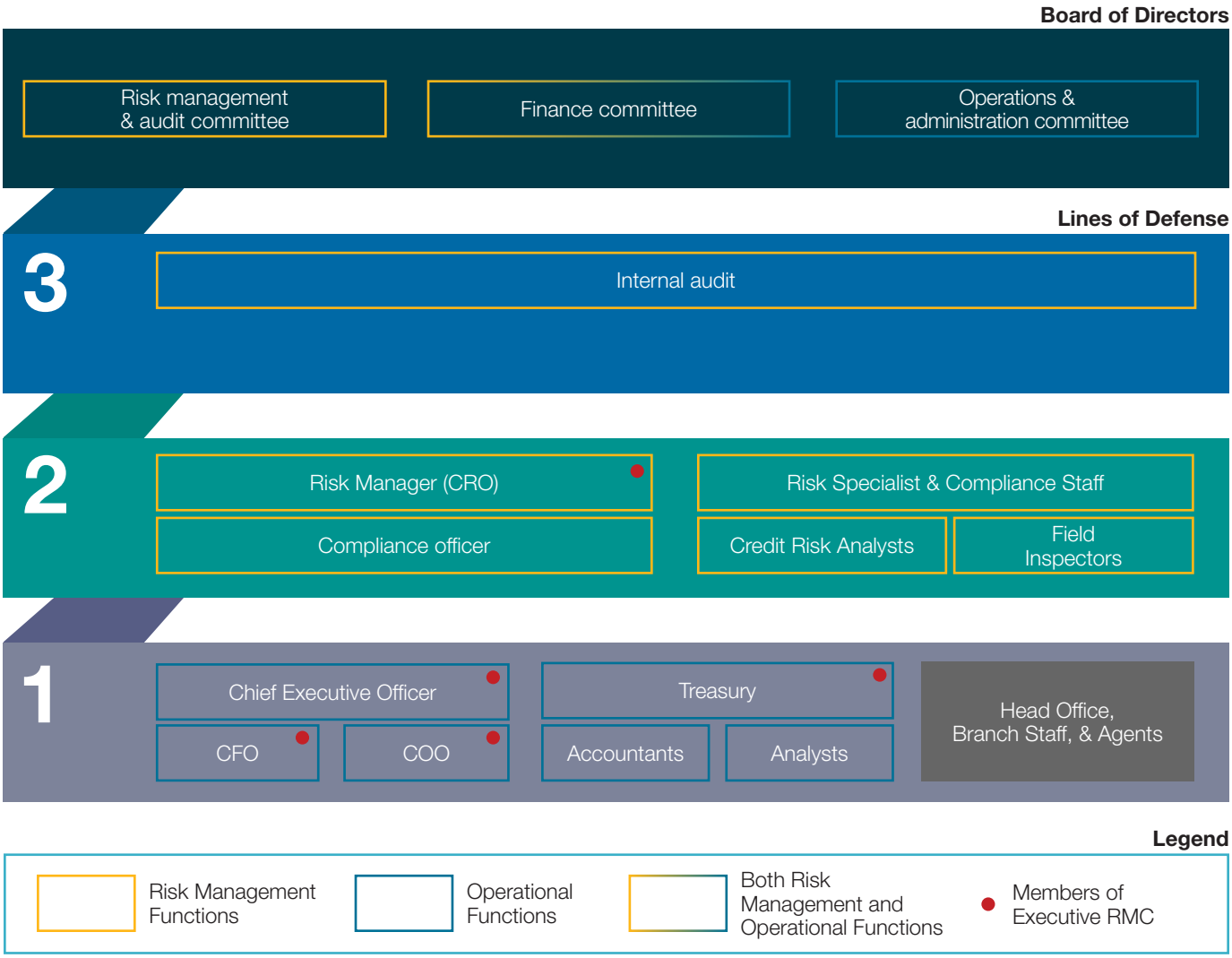
- Open communication throughout the organization
- Sharing knowledge
- Continuous improvement
- Dedicating sufficient resources to risk management
- Use of information and reporting systems
- Commitment to ethical and responsible business practices
- A code of conduct that staff are required to sign onto

Other stakeholders can do their part to set or maintain a risk culture. Investors, in particular, should be wary of imposing aggressive growth targets that could lead a company's risk management to falter. They should also nominate directors who will help establish a sound risk strategy and appetite, set limits, monitor adherence to these, and take action if the company's performance deviates.

2.3 Governance Structures

Once an AFC has set its risk management strategy and expressed its risk appetite, it will require a formal (i.e., explicit and documented) set of structures, reporting lines, policies, and procedures to make sure that the strategy is followed and that risk-taking stays within the set appetite. Collectively, these structures are what we refer to as 'governance' and are depicted in Figure 3.

FIGURE 3. **The structure of risk governance**



This section discusses the four major levels of risk governance in an organization:

- Board of directors and senior management
- Front-line staff and management
- Risk management unit
- Internal audit

The latter three are referred to as the 'Three Lines of Defense.' This section also covers the importance of a strong MIS to risk management. Policies and procedures, although they fall within the umbrella of risk governance, are covered in the following section.

BOARD OF DIRECTORS

Effective risk management starts at the top of an organization. For most companies, 'the top' means the board of directors or supervisory board (for countries with a two-board requirement). The board is the key interface between owners of a company and its executive managers. Thus, this is where risk management strategy and risk appetite must be articulated and where responsibility for overseeing risk management must ultimately fall.

A foundational piece of sound risk governance is a board of directors that includes independent, non-executive members. Appropriate board members must be suitably qualified, effective in their work, loyal to the interests of the institution and its stakeholders, and care about properly discharging their obligations. The board should:

1. Authorize and oversee implementation of the institution's mission, risk appetite, risk management strategy, and related policies.
2. Establish and communicate corporate values (e.g., by means of a code of conduct) which ensure that consumer protection principles are understood and followed, among other items.
3. Install a strong control environment wherein conflicts of interest are mitigated through appropriate policies.
4. Actively oversee the institution's compensation system and ensure that incentives are aligned with prudent risk-taking.

More specifically to credit risk management, the board must ensure that:

1. A sound risk management culture is established throughout the institution and communicated to third parties.
2. Policies and processes are developed for risk-taking that are consistent with the risk management strategy and the established risk appetite, then reviewed periodically and adjusted as the business evolves.
3. Uncertainties attached to risk measurement are recognized.
4. Appropriate credit limits are established that are consistent with the institution's risk appetite, risk profile and capital strength, and that are understood by, and regularly communicated to, relevant staff.
5. An adequate MIS exists that allows them to obtain timely and appropriate information (e.g., the health of the loan portfolio).
6. Senior management take the steps necessary to monitor and control all material risks consistent with the approved strategies and risk appetite.

In a typical microfinance bank, the independent risk and control functions include a RMC, the executive-level forum where risk management happens. The RMC covers both the asset liability management scope of interest rate risk, foreign exchange rate risk and liquidity as well as the all-important credit risk and the related operational exposures in the credit process. The executive RMC is typically chaired by the chief executive officer and includes the CFO and COO plus the Treasurer and Risk Manager as ex-officio members.

Alternatively, if the board is small and its members have the technical expertise, the full board could serve as the risk counterpart. Often, the Audit Committee may play the role of the RMC as well.

THE THREE LINES OF DEFENSE: ORGANIZATIONAL LEVELS OF RISK MANAGEMENT

Modern risk management in financial services is built around a 'Three Lines of Defense' paradigm, which requires companies to achieve the following:

- Everyone, from sales staff to call centers to service mechanics, does their part in controlling and mitigating risk (First Line of Defense).
- Decisions taken at the first line of defense are analyzed by someone who can provide an independent perspective and communicates directly to executives and the board (Second Line of Defense).
- Owners and directors keep apprised of the functioning of the organization by way of an internal audit function that reports findings directly to the board and has only limited reporting to senior management (Third Line of Defense).

While the Three Lines of Defense framework emerged from the banking industry, CGAP's global experience indicates that it also translates well to risk management for non-bank lenders, including MFIs and AFCs. And although the budgets and number of staff engaged in internal control should be scaled to the size and complexity of the business (see Timeline section below), we also find that the first two lines of defense can be implemented by companies regardless of maturity, with the third (internal audit) added as a company grows.

First line of defense — front-line staff and management

Credit risk management happens every time an agent presents a solar water pump at a district fair or someone calls the number on an ad for financed motorcycles. In an organization that distributes, sells and finances assets, most staff members have a role to play in managing credit risk.

BOX 3. **First line of defense**

SunCulture, a company headquartered in Kenya, sells and finances solar-powered water pumps and other assets, and also provides agronomic support to their farmer clients. SunCulture's products range in price from $500–$1,500 and are financed from 24–36 months, as well as being sold on a cash basis. With the size of the asset and the tenor of the exposure, SunCulture has prioritized building a multi-step process for bringing in new clients:

SunCulture sales agents make contact, describe the attributes and terms of the product. If the potential client is interested and meets minimum KYC requirements (national ID, age, credit bureau check, and can make the requisite deposit) they are forwarded to a Relationship Manager.

Relationship Manager assesses the client's intended use of assets (business or personal) as well as their ability and willingness to pay. Additionally the Relationship Manager takes the customer through SunCulture's credit survey process, which is a continuation of updating the profile that the Agent has started. All survey questions are weighted and tabulated into a final 'credit score' which the Relationship Manager takes into account when reviewing the application. This assessment is intended to mitigate overindebtedness of the customer, as well as any fraud. The Relationship Manager approves or denies the application, together with the Head of Credit.

Once a deposit is received, the Engineer conducts a technical assessment of the client's location. They flag any potential technical issues with the site or product's intended usage. Engineers also review and update/provide feedback to the credit team (i.e., if a customer clearly doesn't have a use case for the pump, then they won't install the unit and report back to the credit team).

The Relationship Manager calls the client post-installation to confirm understanding of credit terms and conditions by reviewing the contract (again), as well as the customer's obligations (i.e., confirming they know when and how to pay).

Automated payment reminders are sent to customers 3 days before their scheduled payment day.

In the event of nonpayment, the Relationship Manager follows up with the client to understand the reasons for delay (to help assess if the pump should be turned off or repossessed), and if needed to support in collections and eventually repossession.

Making sure that they are informed and able to do so in their operational capacity is the first line of defense for any AFC. This means that executives need to make sure that all operations are planned, and appropriate policies and procedures are drafted, with risk management in mind.

The first level of controls is always directly embedded in operations through separation of duties: a branch manager will approve the loan applications prepared by his field staff, the head teller in the branch controls the junior tellers' daily ledger, etc. See Box 3 for an example.

In AFCs, the most direct way this happens is through the agents or staff whose responsibility is to sell the physical asset. Because they are the first (and sometimes only) point of contact with the customer, they play an outsized role in avoiding credit risk through customer assessment. Service staff such as those in call centers or maintenance shops also must understand the importance of their role to managing risk. This will be explored in more depth in Chapter 4.

Second line of defense — risk management function

The second line of defense is the risk management unit covering all material risks to the company, including credit. The Risk Manager heads up the unit. In a larger institution, the Risk Manager may be elevated to executive rank and carry the title of Chief Risk Officer. The Risk Manager reports directly to the highest executive officer and has frequent interaction with the board-level risk committee.

Key qualities of the Risk Management unit include:

- Provides a comprehensive company-wide view of risk across all material risk types.
- Captures macro risks arising from the markets in which the company operates, and incorporates such assessments into the company's risk management process.
- Invested with sufficient resources, independence, authority, and access to the Board to perform its duties effectively.
- Supported by information systems that are adequate (both under normal circumstances and in periods of stress) for measuring, assessing and reporting on the size, composition and quality of exposures across all risk types, products and borrower segments.
- Subject to regular review by the internal audit function.

The Risk Manager and the small expert team serve first and foremost as a competence center and as internal consultants in risk management methodology. Their primary responsibility is to support the business units in maintaining and complying with policies and procedures to ensure that all risks are identified, measured and managed. As part of this they are responsible for developing, owning and upgrading risk policies. Risk Management also takes independent risk measurements as necessary (e.g., on a key risk metric such as early repayment) and reports those directly to the board and executive management.

Embedding the Risk Management Unit in Everyday Credit Activities

Even with a well-established and independent risk management unit, it would be unrealistic to believe that self-control by sales agents or credit officers is always good enough. **Meeting disbursement targets today almost always beats portfolio quality in six months' time,** and catching deviations from lending policies or outright fraud a year later at the next internal audit inspection will often be too late. So Risk Management may carry out a second level of risk control using field inspectors and/or risk analysts, who are deployed throughout the organization and oversee staff engaged in credit activities. These risk staff are not generally taking actions on a specific loan/lease but rather are monitoring these activities for compliance with risk policies. This approach weaves a risk perspective directly into the fabric of day-to-day business, where the risk-taking happens (see Box 4 for an example).

BOX 4. **Building a risk management unit**

TUGENDE

Tugende is an AFC operating in Uganda and Kenya. Its primary loan product for many years was a lease-to-own motorcycle for established motorcycle taxi drivers (known in Uganda as 'bodas'). The motorcycle taxi business in Uganda is well-structured, with drivers operating as independent members of local 'stages,' where they operate and are known.

This structure enables Tugende to assess risk locally, through in-person interviews and discussions with other drivers in a stage. It also means that risk management at Tugende is mostly decentralized. While the company was in its infancy, credit procedures were built up over time at a limited number of branches. Eventually these were codified into credit policies, and are now executed at a branch level, with a second level of risk management for oversight.

To ensure that branch credit officers are knowledgeable about Tugende's policies and able to execute them, Tugende created a Head of Risk position. This person is responsible for overseeing compliance with Tugende's credit policies.

- Monitoring portfolio health.
- Updating policies on a regular basis.
- Helping HR to develop risk-based elements of onboarding training.

The Head of Risk reports directly to Tugende's CEO and chairs the RMC. The RMC is also responsible for approving all extraordinary exposures, such as those resulting from the introduction of new products.

The defining feature of a risk management unit should be its independence. This means that risk management staff should not be incentivized on commercial risk-taking, should not be directly involved in credit transactions and should not be subordinate to the business managers whom they control.

In practice, when Risk Managers participate in commercial decisions their vote should not necessarily dictate the final outcome. Otherwise, they might be tempted to say no to everything. Every business failure would be blamed on risk staff, who prevent line managers from building a profitable business. Instead, the vote of the Risk Manager should be positioned as a technical opinion on the compliance of the proposed decision, activity or product within the established risk policies and tolerances. The business managers may overrule the vote of the Risk Manager against a certain transaction in what becomes a documented exception or override. Internal Audit will take a special interest in the nature, frequency and ultimate outcome of such overrides and report those to the Board.

Third line of defense — internal audit

The Internal Audit function is the control level of controls—and the last line of defense. Its remit includes the full scope of the company's activities, but specifically also activities and reports of the executive managers including the CEO, finance and accounting, as well as the risk management unit. Internal Audit assesses the effectiveness of the company's risk management frameworks. It reports directly to the board level, typically the Audit Committee. Importantly, the Head of Internal Audit is hired, fired and evaluated by the board Audit Committee, *not* by executive management. This is to ensure their independence and that the board receives an unbiased view of the company's risk management.

Internal Audit serves as the ultimate control instance, typically carrying out its analysis on an ex-post and sample basis. In a three-tiered control structure, Internal Audit can focus on assessing the effectiveness of the prior controls rather than being relied upon to actually catch and rectify individual errors and omissions.

BOX 5. Risk management self-evaluation

fenix intl
A company of ENGIE

Fenix International is a next-generation energy company that operates in six African countries. Acquired by Engie in 2017, Fenix's Credit Department manages risk through its sales agent network, call center, and device lockout technology.

Given its state of growth, Fenix worked with CGAP to understand how it could incorporate the functions of an Internal Audit department without building out an entire independent unit. In the end, CGAP and Frankfurt School helped Fenix develop a risk management self-evaluation, to be conducted annually in each country by a risk manager from another country. Given that different Fenix country units are run with a significant degree of autonomy, this approach offered the right mix of pragmatism and independence to be implemented quickly.

The actual evaluation helps evaluate the status of various risk management components, which are weighted by their importance. The tool produces a risk matrix, as in the example seen below.

Importance			0 Good practice	1 Adhered	2 Partially adhered	3 Weak	4 Missing			
	Critical	4	—	—	—	—	—	→	Critical	12—16	—
	Significant	3	—	—	—	—	—	→	Major	8—11	—
	Relevant	2	—	—	—	—	—	→	Moderate	4—7	—
	Minor	1	—	—	—	—	—	→	Minor	1—3	—
	Irrelevant	0	—	—	—	—	—	→	Okay	0—0	—

Status

BOX 5. **Risk management self-evaluation** (continued)

This matrix can then be translated into more detailed findings, such as this example here:

Findings

	Category	Sub Category	Issue	Finding	Comment
1	Concentration Limits	Limit Reporting	Responsibilities	Critical	No policies/procedures in place to minimize portfolio risk.
2	Credit Portfolio Risk Identification & Measurement	—	UL Calculation/Stress Testing	Critical	No calculation of unexpacted losses and/or stress testing.
3	Credit Risk Policy & Procedures — Portfolio Risk	—	Process Description	Critical	No policies in place to minimize portfolio risk.
16	Credit Risk Policy & Procedures — Portfolio Risk	—	Diversification Strategy	Major	Diversification driven by strategy/ business focus as opposed to risk management focus.
17	Internal Control	—	Regular Control Field Visits	Major	Control units set-up in the past year. No resident Internal Audit function. Currently internal audit team is from holding company and may not fully appreciate business model.
18	Customer Assessment	Recovery & Collection	Adequate Handover of Problematic Cases	Major	No formal process for handover of defaulting/problematic cases. PHAs face difficulty in tracing "cancelled" clients.
37	Credit Risk Policy & Procedures — Portfolio Risk	—	Risk Measurement & Accounting	Moderate	Portfolio reporting functionality in place. However, reports on concentration, limits, etc. not available.
38	Credit Risk Policy & Procedures — Portfolio Risk	—	Job Descriptions	Moderate	Portfolio reporting available, however, there is no clear assignment of responsibilities for portfolio monitoring.
39	Internal Control	—	Independent Internal Audit Function	Moderate	No resident Internal Audit function. Currently internal audit team is from holding company and may not fully appreciate business model.
63	Risk Limits	Limit Monitoring & Reporting	Time	Minor	none
64	Staff Incentive System	—	Alignment to Fenix International's Social Mission	Minor	none
65	Internal Control	—	Client Satisfaction Surveys & Complaint Procedures	Minor	none
76	Key Risk Indicators (PAYGo PERFORM)	—	Receivables at Risk (RAR)	Okay	—
77	Credit Portfolio Risk Identification & Measurement	—	Vintage Curves	Okay	none
78	Credit Portfolio Risk Identification & Measurement	—	Transition Matrix	Okay	none

In an asset finance context, auditors might check the documentation received for a sampling of borrowers or observe a credit assessment to ensure that procedures are being followed. They would certainly want to ensure that inventory is being managed appropriately, and that recoveries and repossessions are proceeding as intended.

Internal audit is the least common line of defense in the AFCs that CGAP has worked with. However, Box 5 illustrates how a growing AFC can accomplish some of the goals of an internal audit department before it is able to dedicate the full resources necessary.

2.4 Management Information Systems in Asset Finance

Risk management is a data-driven exercise. That data must be recorded and stored on a software platform that:

- Enables staff to access the information they need to do their job
- Allows for the analysis and visualization of information
- Generates relevant reports/dashboards in an accurate and timely manner
- Compels adherence to defined procedure
- Provides a clear audit trail

For the purposes of this guide, that software platform is called a MIS, although some organizations may prefer 'customer relationship management.[11]

The scope of an MIS goes beyond the management of credit risk. Such a system may also be used to track inventory, oversee operations, manage budgets, and for other critical tasks. Some or all of these functions are likely to be carried out by distributed applications (one for inventory, another for accounting, etc.) running on a single network, in which case the MIS may include a data warehouse and middleware to facilitate the movement of information between different systems.

However, in regard to credit risk in asset finance, a properly functioning MIS is what connects the Three Lines of Defense. It is critical for accomplishing the following tasks:

- Recording customer information for KYC and credit assessment
- Approving/processing individual credit transactions
- Monitoring portfolio health and key risk indicators (KRI) (see Chapter 5)
- Monitoring agent activity and tracking commissions
- Analyzing repayment patterns by cohorts/segments
- Auditing credit transactions and risk monitoring
- Managing and communicating with a portfolio of financed assets
- Supporting Board and senior management oversight

BOX 6. **A single source of truth**

In four of our seven projects, we encountered serious issues when we tried to analyze loan repayment data, or replicate company analysis. While the causes varied, in all cases executives were forced to rely on multiple inadequate data sources to inform their decisions.

The single most important function that an MIS serves for a credit manager is as a 'single source of truth' that consolidates real-time transaction and portfolio-level information. **Without an effective and reliable MIS in place, credit risk management is almost impossible.**

This last function is the most prominent for many of our partner AFCs (see Box 6). Particularly in the PAYGo sector, customers' payments need to be rapidly and automatedly processed to unlock their devices. There are several specialized software providers that offer this service, while some companies have developed their own proprietary software.

11 In banking, an MIS refers specifically to a system used for reporting, distinct from a core banking system. However, in microfinance, 'MIS' is often used to refer to the entire back-end system, which is how it is employed here. For more detail see Braniff and Faz (2012).

Selecting or developing an MIS is an organizational process beyond the scope of this guide. Risk managers should be keenly aware of their requirements for an MIS, and ensure that these are met. The MIS also introduces an element of credit risk: for example, a failure to unlock assets will quickly cause a payment crisis. Regularly updating and testing risk-adjacent software is one of the risk management unit's responsibilities.

2.5 Policies

Having set up the structures and systems for implementing a risk management framework, the next step is to give them something to do. Risk management policies take general concepts, processes, responsibilities, and actions and formalize them into written documents. A formal risk policy helps to ensure consistent implementation and company-wide understanding of the various procedures, responsibilities and processes around risk management. Written policies are also essential to create trust for third parties such as investors or regulators. They inform workflows, onboarding and periodic training (see Box 7), although they may need to be translated into other media to be most effective in staff training.

Policies should be directly aligned with a company's risk management strategy. In asset finance, that could mean that management of 'problem loans' may focus more strongly on repossession (including refurbishment and resale) and remote lockout (if applicable) than on rescheduling or denying access to future loans.

As an institution grows, so too will the number of policies it establishes and the level of detail. For example, a company may start with general risk management policy, then add another specific to its more important risk, such as a credit risk management policy. The details can later be described in supporting documents such as work procedures or process charts.

Risk policy documents should be developed, "owned" and regularly updated (see Box 7)—typically at least on an annual basis—by the Risk Management Department (or

BOX 7. **Translating policies into training materials**

TUGENDE

Tugende has a comprehensive in-house training system managed by a Deputy in its HR department who is responsible for training at the company. Training for newcomers includes one-week onboarding training that includes an introduction to all departments and functions, a one-week induction training received from the functional supervisor and then an on-the-job training and probation period of three-to-six months.

Tugende offers corporate and functional courses for its employees and provides refresher functional training, communication skills, critical thinking, typing skills trainings as well as Training of Trainers. Permanent staff develop a personal training plan aligning it with their own chosen career path. Ambitious employees may apply for a leadership training program, which involves gaining expertise and exchanging experience by rotating between different branches and departments. Tugende has a team of nine in-house trainers (seven of them from operations) and provides classroom training and online training done through an educational platform, which includes testing. The company also uses external training providers and partners with a local banking institute.

However, in some cases evaluators found that employees had a different understanding and interpretation of the procedures, which affected processes standardization and thus could increase the risk. This mismatch between procedures and practice also affected training, which is based on written procedures. This was a clear sign that policies and training need to be regularly updated, then monitored for their compliance, especially in high growth companies.

similar body). It is recommended that their approval be executed by the senior management and/or board.

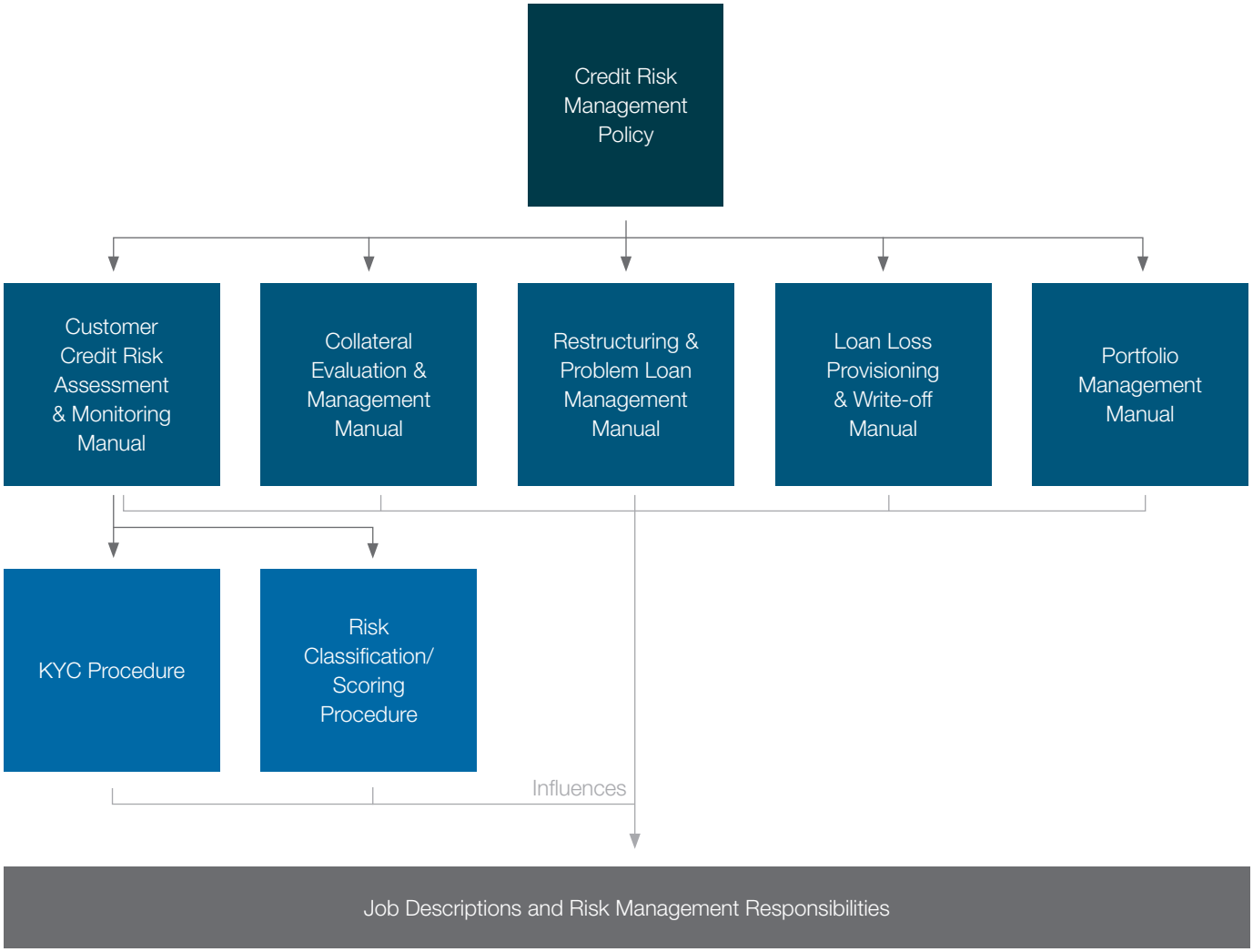
CREDIT RISK POLICY

For AFCs, having a solid credit risk policy framework is just as important as it is for banks and MFIs. The same goes for the major topics that must covered by such policies (as well as accompanying manuals and procedures) and which can be broadly divided into transaction and portfolio risk management actions. For small providers it may be appropriate to integrate all this into one credit (risk management) policy. The following outlines the core ingredients of a possible credit policy, although companies may wish to add additional elements (see Annex 2 for more detail).

- Introduction (vision, mission, risk management strategy, risk appetite)
- Organization of credit (organizational structure, staffing, job descriptions, roles/responsibilities)
- Loan/lease products
- Processes (assessment, onboarding, monitoring, cross-selling, collections, recovery)
- Standards and compliance (consumer protection principles, internal code of conduct)
- Portfolio management (segmentation, limits)
- Reporting (KRIs, reporting frequency)

As an organization grows, their credit risk management policy framework may look like Figure 4.

FIGURE 4. **Credit risk policy framework template**



JOB DESCRIPTIONS AND TRAINING REQUIREMENTS

Risk management policies typically include short job descriptions for all relevant positions, as well as the key risk management tasks that they must be trained and able to carry out. For AFCs, this is an opportunity to map out how risk should be managed throughout an organization, even for employees whose tasks may not appear to be directly related to credit. The goal is to convey that 'everyone is a risk manager' in their given role.

Job descriptions should include key activities, critical company risks related to their job, detailed explanations of important risk management actions, and an example of how any risk-related compensation is rewarded.

Initial and periodic training is the main way that staff will be introduced to the company's risk management strategy, risk appetite and risk culture. These trainings should be put together with great care. Training of trainers is therefore of fundamental importance and an area where the company should dedicate resources. Case studies should include real-life instances where the company fell short in managing risk, and how it could have done better.

All of the above (policies, job descriptions and training) become more important, not less, for third parties such as sales agents. In asset finance these parties typically carry out critical tasks but are more difficult for the organization to manage as they are not employees. Policies need to factor in the particular role they play, and the challenges that creates for risk management.

Lastly, we strongly recommend formalizing every staff member's commitment to respect the company's code of conduct, for example when it comes to abusive collection measures. A code of conduct is a written collection of the rules, principles, values, employee expectations, behavior, and relationships that an organization considers significant and believes are fundamental to their successful operation. It should be available on a public folder, read and signed by every staff member. The code contains guidelines for appropriate behavior toward colleagues, clients, and other stakeholders. It clearly states what is considered misbehavior and lists possible sanctions. It has a reference to general customer protection rules (e.g., GOGLA, SMART) and addresses issues like sexual harassment, physical and psychological violence, racism, etc.

SUMMARY: PUTTING POLICY INTO PRACTICE

Experience shows that in companies with more than a handful of people, formalization is necessary *but not sufficient* to ensure that behavior on the ground complies with the organization's policies. For many AFCs a formal policy framework will have little direct impact on fieldwork, as few agents or even junior staff are likely to read it or commit it to memory. Instead, the policy framework should inform standardized trainings, ongoing staff capacity building, consistent leadership, a system of checks and balances, and well-designed incentive structures. These are the components of a well-implemented institutional risk management system, of which credit risk management is a major part.

2.6 Implementing Risk Management

INTERNAL TRAINING AND COMMUNICATION

How often, and in what way, organizations choose to communicate their expectations around risk management has a significant impact on its implementation. There are several key stages in the communication and training of risk management content:

1. **Staff sensitization.** Management must ensure that every staff member understands the importance and principles of risk management. At a minimum, everyone involved in credit operations must understand that any scheduled payment that is not received, or arrives later than expected, has a negative effect on the company's cash flow, profitability and impact. Staff need to know that if non-payments reach a critical mass, the long-term survival of the company may be at risk.
2. **General risk training.** Risk Management staff should provide regular classroom sessions for all new staff, which include participatory exercises and group work. Infrequent but regular refresher courses for all experienced staff are also important. For staff involved in credit risk management, trainings should start with a general risk awareness training, and later focus on the particular work each staff member is expected

to do, and how their role helps to manage risk for the entire company. Back-office staff responsible for provisioning and loss calculation require specific training in those areas, while Loan Officers require more training in customer analysis, questioning techniques, etc.

3. **Interactive learning.** Very few, if any, non-risk staff will be interested in memorizing technical details. Most people tend to learn better through interactive learning formats, including group work, collective discussions, and role plays. Here is an example (Figure 5).

FIGURE 5. **A fun example of how to communicate risk concepts**

4. **Cross-fertilization of ideas.** Risk staff ought to regularly present their work to other departments of the company, as this is useful to create mutual understanding. This is not meant to completely eliminate the natural tension between business and risk staff—**a friction which is healthy and needed to a certain extent**. However, having an idea of how the "other side" works and why it assesses things as it does can help to facilitate constructive discussions and a search for problem-oriented solutions. By the same token, 'non-risk' staff should also be encouraged to provide risk staff with feedback on policies and any emerging issues they may observe.

5. **Updates.** When policies change, all affected staff should be informed in an interactive format (typically a classroom presentation), highlighting the key changes and the impetus behind them, demonstrating their implementation through examples or role play and offering plenty of time for questions.

MANAGING STAFF AND INTERACTIONS

While some aspects of good risk staff management are similar to those of other business units (clear reporting lines, well-articulated goals and priorities, open communication channels), risk management relies heavily on the concept of checks and balances. A company should ensure that Dual Control and the Four Eyes Principle, as examples, are widely implemented in practice.

Four Eyes Principle. This requires that any activity by an individual within the organization with a sufficiently serious risk profile (as determined by company policy) must be reviewed or double checked by a second competent and independent individual. This is done to mitigate the risk of poor execution through mistake, oversight or fraud.

Dual Control. This is similar to the Four Eyes Principle, but more stringent. It requires that a sensitive activity may only be undertaken when two people are simultaneously present.

These can be especially relevant for assets that require both a technical and financial appraisal of the customer. But the basic principle of involving another staff member in a credit decision is a key tactic for ensuring that practices are complying with policies.

Additional checks and balances can be operationalized in several ways (See Table 2).

TABLE 2. **Technical checks on risk taking**

Dedicated IT user rights	Approved rights to read, write or change certain information in the system.
Mandatory second vote recorded in the system	For critical issues (e.g., a credit vote), the system would require a second review, to be confirmed by ticking a box and recorded in the system.
Formally assigned approval rights	Similar to IT user rights. Credit decisions can only be made and recorded by persons who have the approved right to do so.
Automated flag of limit breaches	A system warning in case of limit breaches – (e.g., e-mail notification for management and controllers).
Built-in log files	Recording login and logout times for all system users. Helpful for fraud detection (e.g., repeated night access or stolen passwords).

The internal audit function, as the third line of defense, would be the body to ultimately check on-the-job compliance with what is fixed in the policies. Each core function should be checked about once a year by an internal auditor, who would record policy violations and report those to the board. Such checks can be sample based—not necessarily random but representative, perhaps with a stronger emphasis on riskier exposures (e.g., by checking not only files from "good" loans but also those from defaulters and restructured cases). While generally pre-announced, a couple of audit visits may even be conducted as surprise visits.

STAFF MOTIVATION

Incentive systems play an important role in aligning quantity and quality targets, and should match with both the company's mission and its risk appetite. These could include sales commissions, good-portfolio bonuses, recovery commissions, and others.

Typically, customer care is split into different activities, such as customer acquisition and analysis, troubleshooting, maintenance, arrears management, and collections. This makes it easier to measure the performance of each team and to avoid "perverse incentives."[12] For a relationship manager who intervenes in cases of early arrears, the incentive might be negative: a deduction from their good-portfolio-bonus based on any balances that exceed their set arrears threshold.

We explore some of these incentives in more detail in Chapter 4. For risk managers, their job is to regularly review whether these schemes are having the desired effect, whether they are creating perverse incentives, or even leading to outright fraud. Internal audit will wish to check a sample of these bonuses or commissions as well.

2.7 Timeline for Adopting Risk Governance

No institution is immune to borrower default, employee fraud, theft, reputation risk, foreign currency exposure, or other particular risk dimensions just because they are small. Quite the opposite: smaller and less mature organizations are more vulnerable to unexpected losses from risks that they do not understand or lack the capacity to mitigate. Risks do not wait, and therefore it is never too early to begin managing them. As many companies turn to on-balance sheet financing in absence of a willing financing partner, long-term viability will depend on established structures for managing risk.

At the same time, there is not a one-size-fits-all approach to managing risk. We do not advocate for companies or their investors to impose an oversized internal control monster upon early-stage asset finance businesses. Many innovative AFCs are comparably young, remain on the smaller side when it comes to revenue and portfolio size, and cannot afford to hire full-time internal auditors or risk managers.

Our approach in this guide is rather to set out widely accepted and effective practices that are easily scalable to fit the complexity and budget of a particular company. As companies grow, we would expect their internal control units to increasingly resemble those of larger financial institutions. But smaller organizations can still find ways to ensure that these responsibilities are carried out. As an example, an early-stage start-up may have the second line of defense covered by the CFO, while internal audit can be outsourced to external auditors as a separate task from their traditional financial audit.

12 Perverse incentives could arise, for example, if a relationship manager or loan officer would be entitled to the same bonus on collections as a member of the escalation team. There have been cases where a loan officer actively encouraged clients who were in early arrears to not pay right away, but to wait until the next month to make the installment. This would mean an installment collected from a client in 91–120 days rather than in 61–90 days and thus a higher incentive on the recovered installment.

Table 3, as well as the section below, presents several key pillars of risk governance and how they might evolve over time in a growing asset-finance startup:

1. **Senior management/separation of functions.** Existence of at least a full-time CEO and CFO. For companies with >$10 million in assets, a full-time Risk Manager. For companies with >$25 million in assets, a risk management function and an internal audit function; fully independent up to the management level.
2. **Formalization and dissemination of policies.** Existence of at least a Risk Management Policy. For institutions with lease portfolios >$25 million (or equivalent) supplemented by up-to-date credit manuals, credit risk management procedure, financial management manuals, and internal control manuals, at a minimum.
3. **Ex-post controls.** Internal audit controls verify the risk management framework (including but not limited to credit risk) regarding both formalization and practice. In a small institution (lease portfolio below $25 million or equivalent), the internal audit may also be outsourced to an external auditor or consulting firm.

TABLE 3. **Risk management needs, by stage, for growing AFCs**

	Early-stage ($0-$10M portfolio)	Growth ($10-25M portfolio)	Maturing ($25M+ portfolio)
Vision and Mission Statement			
Risk Appetite Statement			
Board of Directors			
RMC			
Risk Management Policy (incl. Credit)			
Risk Culture			
MIS			
Chief Risk Officer			
Internal Risk Management Dept.			
Internal Audit Dept.			
Detailed Process Manuals			

CHAPTER 3
PRODUCT DESIGN

BEFORE A CLIENT BUYS A PRODUCT on credit there needs to *be* a product to sell. In the case of asset finance, a 'product' consists of both a physical, tangible asset, as well as a financial product that allows the customer to pay for the asset over time. The features of each of these products, and the relationship between them, do much to mitigate or increase the risk of individual client transactions.

3.1 Physical Product Design

The quality of the physical asset being financed is the single greatest variable in managing credit risk for asset finance providers. Meeting customers' intended purposes is a key outcome of responsible finance. It is also important for mitigating credit risk. Put simply: if the asset does not work as expected then people will not pay for it. Low-income customers of AFCs are unlikely to be concerned about future credit from those companies, and even less likely to be worried about their credit score—although companies are increasingly introducing new products available to customers in good standing and that may incentivize credit discipline. In the absence of these incentives, physical asset performance is a necessary (though not sufficient) condition for managing credit risk.

A few of the major risk factors in physical product design are captured in Table 4.

Executives, product designers and procurement leads should have these features in mind when deciding which products get offered to customers. But credit risk managers are also well within their rights to weigh in on physical product attributes that drive risk, to propose solutions for mitigation or to advocate for less risky asset features, types or brands (see Box 8).

Despite the importance of the physical product, its quality and value will not eliminate credit risk. Clients may have the

SUMMARY

- Asset finance entails the sale of both a physical asset and a financial product. The design of each can play a major role in mitigating or exacerbating credit risk.
- The quality of the physical asset is the single greatest determinant of credit risk for AFCs. If customers are not satisfied with the physical asset, they are much more likely to stop paying.
- Determining effective interest rates is a challenge in asset finance due to the subjectivity of retail vs. finance costs. But it is crucial for allowing customers to make comparisons and setting a benchmark rate for financial decisions.
- Pricing is a key tool for many companies in their risk management, but it cannot wholly replace risk management. Using longer tenors to make regular installments affordable can create credit issues down the line, as fatigue sets in and newer assets become available.

TABLE 4. **Risk factors in physical asset design**

Value for Money	Customers will intuitively compare the value they get from an asset with what they are paying. If there is a value deficit, the risk of default increases.
Durability	How often does the product break? Product malfunctions lead to delayed or foregone repayments and additional costs of collecting products and swapping them out for customers, not all of which are covered by warranty.
Longevity	How long does your product function as expected? For borrowers, this determines how soon they will need to purchase a replacement.[a] For borrowers and lenders, it determines what potential resale value it may have, either at completion of the loan/lease, or at time of repossession.
Dependency	What infrastructure does your product need to work? Lack of access to a necessary component (e.g., fuel, power, mobile network) can have an abrupt and negative effect on repayment.
Interoperability	Does your product link with other products? One trend is for asset companies to create proprietary product ecosystems, 'walled gardens' of products that only speak to each other. This has advantages: it regulates quality and creates cross-selling opportunities. But it also limits the resale value and may trap the customer into purchasing higher-priced assets.

a Essentially this describes a depreciation schedule, which most customers will grasp intuitively.

willingness to pay for a high-quality product, but that will not make up for a lack of repayment capacity (see Box 8).

CREDIT TECHNOLOGY

Technological innovation is one of the key factors enabling AFCs to reach low-income customers:

- Remote lockout enables flexible PAYGo financing.
- Machine-to-machine communication creates huge amounts of analyzable data on consumers.
- Digital payments allow remote and distributed customers to easily pay for their assets, while also providing a digital trigger for device unlock and clear data trail for investors and auditors.
- Remote sensing technology like GPS tracking lowers the risk of asset finance by allowing companies to easily repossess their collateral in the case of default.

Each of these has the potential, on net, to be beneficial for customers, as without them financing might not be available at all. However, they do raise a raft of consumer protection concerns. At a bare minimum, customers need to be fully aware of any technology that could affect their future use of an asset, as well as anything that is gathering and sharing data on their use patterns and movements. More mature industries should consider having an independent evaluator of products that can conduct independent reviews and flag practices that have the potential to disadvantage customers.

Every piece of credit technology also adds to the overall cost of an asset. At regular intervals companies can evaluate what value (such as lower defaults or higher

BOX 8. **Returns to scale in physical assets**

One simple variable—the quantity of your assets that the manufacturer produces—drives key features such as price, warranty and ease of service. Assets produced in high quantity will, all else being equal, generally have lower unit costs and be more readily replaceable. This enables shorter financing terms and greater customer value.

The practice of CGAP partner Greenlight Planet demonstrates the benefits of scale. Before entering into consumer finance, it had already sold millions of solar lanterns and home systems. When the organization made the decision to develop its own consumer financing in 2015, it had already built "a relentless focus on providing well-designed, high-quality, yet low-cost, products for off-grid consumers globally." This enabled it to keep financing tenors between 9 and 12 months while still providing affordable prices to customers.

recovery rates) is brought by individual pieces of 'credit-tech' and compare that to their cost. A/B testing of key features can help to isolate their impact, for example by selling a subset of units without the lockout technology enabled to better understand its effect on the probability of default (see Box 10 for details).

Credit technology is an important tool. But there is no mechanical substitute for properly structuring a credit organization, knowing one's customer, setting limits on risk-taking, and operating within those limits. Relying solely on technology to manage risk is unlikely to succeed.

CASH PRICE

Any asset that can be purchased with a loan or lease should also be available to purchase up-front. The cash price of an asset is also the 'principal' (the amount being financed) of an asset-backed loan or lease. The cash price should be determined by:

1. Landed cost of goods sold (COGS)
2. Marginal operating expenses (marketing and customer acquisition costs)
3. Fixed operating expenses (staff, working capital expense)
4. Expected return (i.e., profit)

We would not expect the cash price to cover consumer finance costs, such as risk assessments, credit losses, or the cost of funding a loan portfolio. However, there are some

BOX 9. Quality without repayment

One of CGAP's asset finance partners carries out regular customer surveys. As of June 2020, its Net Promoter Score (a standard measure of customer satisfaction) stands at 75, which is very good. Clients value the quality and after-sales services of the company, according to the customer service manager.

However, portfolio quality shows a different story, with the share of loans more than 30 days overdue significantly exceeding organizational targets. The vulnerability of low-income clients remains a major risk, with lack of money and logistical issues with payment given as the main reasons for not paying. It is rare to find clients who do not repay because they are dissatisfied with the product. The logical conclusion is that these clients have been oversold a product that they cannot afford. The role of the credit risk manager is to ensure that the company does not solely look for scale in credit, which might lead to sales to clients who have the willingness, but not the capacity, to repay consistently for the asset over the pre-determined period, hence raising repayment risks.

BOX 10. Lockout effects

In 2016 and 2017, CGAP partnered with Fenix International to help scale a digital loan product for established PAYGo solar customers. The loan was offered to customers who had paid off a solar loan or were in good standing on a current loan and was meant to help them in paying school fees, which are a significant expense in Uganda (see Waldron and Emmott (2018) for details). Crucially, the loan was collateralized using the PAYGo lockout technology: if a customer missed a loan payment, their SHS was automatically locked.

In 2018, researchers from UC Berkeley ran an experiment using that loan product. They offered school fees loans to two groups of people: one group was offered the loan *with* lockout, while the other was offered the same loan, *without* lockout. But within the lockout group, a subgroup of borrowers were not actually locked out, even for nonpayment. The researchers then monitored the repayment patterns of these three groups, as well as a control.

The results, presented in Wolfram et al. (2021 *forthcoming*), show that lockout technology reduced the default rate by 13 percentage points. One third of this effect was due to self-selection: people who knew they would be locked out of their SHS if they failed to pay chose not to take the loan. The other two thirds of the effect was due to a reduction in moral hazard: customers who knew they would be locked out made more payments, whereas those who could use the unit regardless did not pay as much.

costs which could reasonably be allocated to either or both 'sides' (sales or finance) of an AFC. For example, if a sales agent is responsible for filling out a credit questionnaire, some portion of their commission may be accounted as a finance cost, while the rest would be a sales cost. Other examples include but are not limited to:

- **Fixed operating expenses**. Business expenses such as rent or utilities may be incurred to support both sides of the business.
- **Cost of customer acquisition**. Both the finance and sales sides of the business may incur costs to serve customers brought in by community demonstrations, such as fuel and marketing collateral.
- **Cost of credit technology.** The purpose of lockout hardware/firmware is strictly credit-related and should be allocated to the finance costs.

The importance of this allocation decision is addressed in the discussion of interest rates in the next section.

3.2 Financial Product Design

Designing an asset-backed loan/lease product is a complicated endeavor. It involves a host of variables, including cost of goods sold, customer acquisition costs, cost of funds, and elasticity of demand. While many of these are independently determined, finance departments can manipulate financing terms to reduce (or increase) their risk exposure. This section covers the following terms, as well as their implications for risk exposure and consumer protection:

- Interest rates
- Tenor
- Flexibility
- Deposits

INTEREST RATES

Interest, or the price paid to use an asset (whether it be physical or financial), is meant to reimburse a lender for the time value of the money lent, compensate them for the risk they took in lending it and cover any of their expenses incurred in funding, origination, servicing, or collecting the loan (Chen and Elliehausen 2020).

Every company that charges more for a financed asset than it does to sell the same asset in cash has an effective interest rate (to learn how to calculate the effective interest rate, see Annex 3). In our experience, this rate is not always empirically determined by AFCs, and is even more rarely communicated to customers. This lack of clarity can lead to pricing failures for the provider, where customers end up paying higher effective rates if they repay early (see Box 11). At the same time, a lack of transparency on the true cost of the loan/lease hurts customers.

BOX 11. **Effective interest rates in practice**

The following is based on pricing from one of our asset finance partners. Note that although the total cost of credit is lowest for customers taking a 3-month lease, they are paying (by far) the highest effective interest rate. In reality, it should be the opposite, as the shorter-term lease is both cheaper and less risky to serve.

	3 months	12 months	30 months
Deposit (USD)	78.75	70.5	26.7
Monthly Installment	78.75	21.9	11.7
Total Cost	315	333.3	377.7
Effective Interest Rate	91.29%	39.43%	25.90%

Determining interest rates in asset finance

In MFIs, as in most financial institutions, interest rates are determined by a set of four basic factors (Rosenberg et al. 2013):

- Cost of funds
- Loan loss expense
- Operating expense
- Profit

These factors are equally relevant to asset finance. A company's interest rate should be sufficient to cover the costs of funding a loan portfolio, expected credit losses, operating expenses related to its origination, and a sufficient profit margin. The EL may vary by market, product, and customer segment, which is why risk-based interest pricing can be helpful: it sets an interest rate that matches the historical EL of a similar loan to a similar borrower.

Once an interest rate is calculated, an organization can arrive at the total financed price to the customer. The only variables needed are (1) the lease/loan term, and (2) the cash price.

As shown above, determining the latter can be a challenge. Most AFCs effectively run an asset business and a finance business. Allocating all of the shared 'costs' to the product side will make the cash price more expensive and interest rates appear lower. Doing the reverse (allocating all costs to the finance side) will make interest rates appear higher.

In general, we do not observe many companies allocating costs between 'sales' and 'finance' to arrive at an effective, risk-reflective interest rate. In fact, there is often no internal division between these units, and no solid justification for the relation between cash and lease prices.

These problems are addressed in depth in Sotiriou et al. (2018), as is a potential solution: providers can go through a cost allocation exercise that yields a clearly defined cash price. This, in turn, will allow them to define appropriate, risk-based interest rates.

Why is it important to know your interest rate?

Having a transparent interest rate:

1. Enables customers to understand what they are paying to purchase an asset vs. what they are paying to finance it. This also allows them to compare asset finance with other financing options (e.g., a loan of comparable value from an MFI);
2. Establishes a benchmark rate of return, an important variable in evaluating options for financing and refinancing a portfolio, as well as assessing performance in flexible payment regimes;
3. The effective interest rate also serves as the discount rate, which is crucial for net present value (NPV) calculations, such as those required in recovery analysis (see Chapter 5).

TENOR

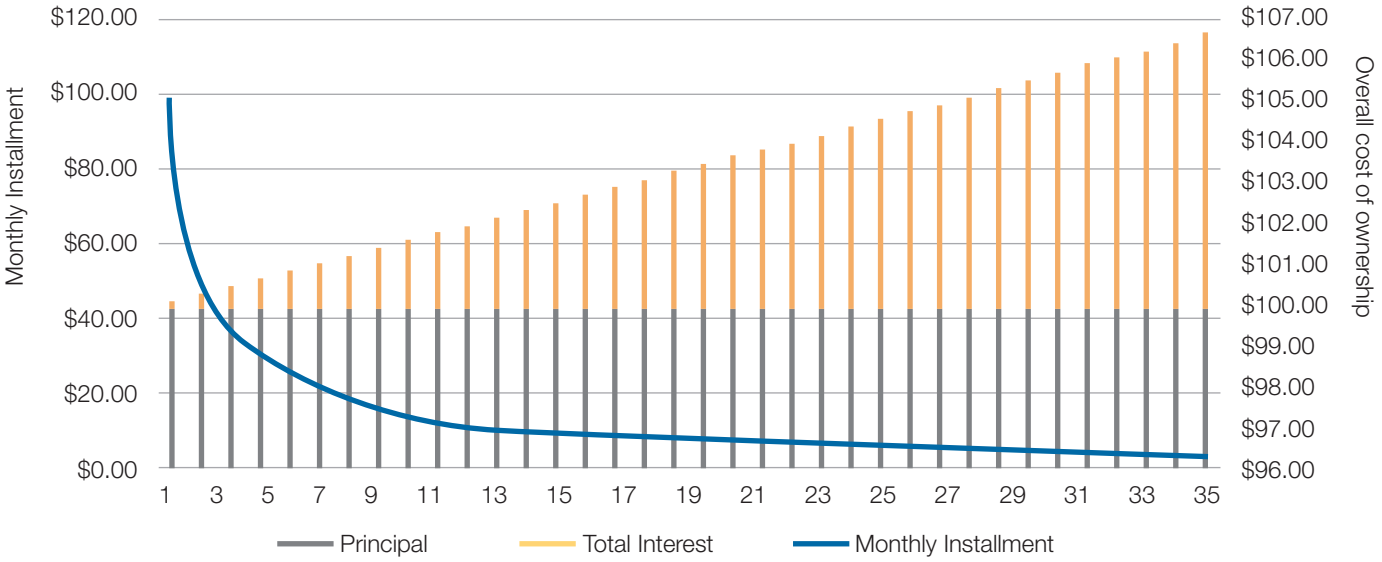
The tenor or term of the loan/lease contract determines over how many months the customer is *expected* to repay (how long they can take to *actually* repay depends on the amount of flexibility they are given). The loan/lease tenor has a negative relationship with the individual payment size, and a positive relationship with the overall cost of the loan/lease (see Figure 6). This dynamic has important consequences for credit risk.

Imagine an asset with a cash price of $100, financed by a company at a 48 percent annual interest rate that is compounded monthly, for which the customer makes monthly payments.

- If the tenor of that loan is 12 months, the customer must pay $10.24 a month, or $112.14 in total.
- If the tenor is increased to 24 months, now the customer only pays $6.11 a month, but the overall cost has increased to $146.66, as their interest expense has quadrupled.

On its face, this may seem a simple choice for companies working with low-income customers: stretch the loan out as far as possible, make the monthly/weekly/daily price as low as you can, and reach as many customers as possible.

FIGURE 6. **Relationship of tenor, monthly installments, and overall cost of ownership**



But companies that do so are significantly increasing their credit risk, in ways they may not always appreciate or price in (see Figure 7). These include:

- **Technical obsolescence.** Devices such as smartphones get better every year. Newer, cheaper assets could lead customers to stop paying for older models.
- **Technical failure.** Increasing tenors put ever more pressure on the devices themselves. If they break, the costs of replacing or repairing the asset—even if covered by warranty—may make the loan unprofitable (Waldron 2020).
- **Income reduction.** Many low-income customers have seasonal or irregular incomes and are vulnerable to financial shocks (e.g., a lost harvest or family injury) which may reduce their ability to pay. The probability of such events, and therefore of default, increases with time.
- **Fatigue.** If customers get bored with an asset or tired of making regular payments, their discipline to sacrifice and keep paying may erode.

These combine to increase the probability of default and therefore the cost of risk. This 'risk premium' should be fully priced in, but also must be accompanied by strong credit processes. In our experience when risk is priced in without controls there is no cap on the risk premium, and it can rapidly increase, forcing good clients to pay ever-higher prices on behalf of the bad.

FIGURE 7. **The pros and cons of increasing loan tenor**

AS LOAN TERMS LENGTHEN

PROS

- Asset installments become more affordable
- Sales increase

CONS

- Overall costs to customer go up
- Credit learning cycles take longer
- Greater risk of technical failure/ obsolescence

There is also a knowledge cost to lengthening tenors. Credit risk management is an *iterative exercise:* companies need to go through multiple loan cycles and analyze the results before they can perfect their models. Shorter loan tenors allow for faster analysis and adaptation, which in turn leads to better performing portfolios and stronger companies.

In general, loan tenors ought to be kept as short as possible, but as long as necessary. Setting a loan term is an important decision that determines the installment price, and each company must make its own choice bearing in mind their risk appetite, asset attributes and target client.

FLEXIBILITY

One of the much-discussed innovations in asset financing in recent years has been the emergence of flexible, PAYGo financing (see Box 12 for an example). This has added a new and complex tool to the asset finance toolbox, and another decision point when designing a financial product. In this section, we explore the implications of traditional and flexible approaches to financing assets.

Traditional Financing

Traditional microfinance providers do not generally offer flexible loan terms. Rather, payments are expected on a given date (e.g., the first day of every month), and missed payments are taken seriously:

1. If a client misses a scheduled payment by a few days, then pays, they were *delinquent* for the period of nonpayment.
2. If payments are missed by more than 30 days, the loan begins to show up in Portfolio at Risk (PAR) metrics (discussed in Chapter 5), and the financial institution will begin provisioning for higher losses. The loan remains 'at risk' until all missed payments (arrears) are repaid, and the client is current on their repayments.
3. At 90 days late, the lender may begin legal action and attempt to recover collateral.
4. At 180 days late, the loan may be written off and sold to a third party for collections.

Many AFCs, particularly those financing larger or more commercial assets, also employ this approach to financing. They expect regular payments on scheduled dates, and if these payments are not made, it triggers actions similar to those described above. When these companies use lockout technology, the asset is normally only deactivated after some time has passed from the missed payment (15–45 days). For assets that generate income (i.e., productive assets), this grace period allows clients to generate income to use for repayment.

BOX 12. **How PAYGo solar works**

Fictional company SolarCredit sells a PAYGo SHS that is priced at $115, which includes a $25 down payment and $90 to be repaid over 12 months (the cash price is $80). Over 365 days, the PAYGo price is roughly $0.25 per day. As in most PAYGo models the $90 amount is fixed; interest does not compound, nor are late fees tacked on for slow repayment.

Now imagine a customer pays $2 on June 1, which is Day 1 of their loan. This amount equates to 8 days ($2/$0.25 per day = 8 days), which is how long their SHS will be unlocked. At the end of Day 8, their purchased 'energy days' elapse, and the unit shuts off. This customer, for whatever reason, does not pay again until June 12 (Day 12), when they again make a payment for $2.

With PAYGo, the three missed days (June 9-11) are not treated as 'days in arrears' and are not expected to be 'made up'. Rather, the expected end date of the contract is implicitly rescheduled (extended) with each missed payment. On June 11 in our example the customer has paid for 8 out of 11 days since the inception of their contract, and they have 357 days remaining to purchase (365 minus 8), meaning their expected completion date is now June 3rd of the next year (three days later than initially scheduled). After a bit more time has elapsed, SolarCredit should be able to determine the repayment profile for this customer and calculate an expected completion date and a probability of default based on historical experience.

Flexible financing

Companies financing smaller assets, such as solar home systems and smartphones, are increasingly using more flexible terms, such as PAYGo financing (see Box 12). By linking payment for an asset-backed loan to use of that asset, PAYGo allows a borrower to repay a flat loan amount in flexible installments over time. The flat amount includes the price of the asset and interest. Units are deactivated automatically for nonpayment, but arrears do not accumulate. This conforms better with

TABLE 5. **Advantages and disadvantages of flexible payments and fixed payments**

	Advantages	Disadvantages
Fixed	• Prioritizes discipline and confers clear penalties for non-payment. • Easier to raise liabilities to fund fixed-term loans. • Simpler to monitor on an individual and portfolio basis. • Risk and return are aligned: customers who repay faster (i.e., lower risk and higher return) pay less in interest.	• People working in the informal economy may struggle with fixed monthly payments. • Fear of missing a payment may scare off the most conscientious borrowers. • If payment is linked to use of an asset, then clearing arrears becomes financially difficult, as the user would have to pay for usage they never actually get. • Compounded interest can make it confusing for borrowers to understand the total amount they will be paying.
Flexible	• Conforms better to the 'lumpy' unpredictable incomes of borrowers working in the informal economy (Collins et al. 2009). • Easier for borrowers who have missed a few days to resume payment, without paying an additional penalty. • Flat amount to repay is more intuitive for borrowers. • Pre-payment for use of an asset is a familiar behavior (e.g., mobile airtime). • Can allow poorer borrowers to lower the effective cost of owning the product (see Box 12).	• Does not require repayment discipline. • Difficult to know, until a large number of loans have been repaid, how long it will take to recover capital. • Harder to identify risky customers. • Ignores the time value of money: · Repayers who finish their contract early often pay much higher effective interest rates, even though their risk is lowest and their return for the company is highest.[a] · Slower repayers who take longer than the nominal tenor create opportunity cost for the company, as the outstanding capital cannot be redeployed to finance new assets.

a It is standard practice to offer discounts to early repayers. But such discounts do not usually discount by the full time value of money (which in this case is the effective interest rate on the loan/lease).

low-income households' income patterns, but can create uncertainty around average repayment time, particularly for new companies. Table 5 compares flexible and fixed repayment schedules.

Flexible or fixed?

The implications of PAYGo financing on portfolio analysis will be discussed in more detail in the next chapter. But no matter the amount of flexibility offered, the time value of money concept still applies, whether in calculating lease installments or in pricing of recovery streams (e.g., from re-sale of repossessed items). That concept should be applied to flexible payment schemes, as well. Assuming that benchmark interest rates are positive, a top-up payment made earlier is worth more than the same payment made later—whether a later payment is contractually allowed or not. *When* payments are made matters, so it follows that earlier repayers should pay less.

Risk pricing

One way for an AFC to mitigate credit risk is to price its EL into the cost of a product, the interest rate, or both.

On a portfolio basis, EL is the product of the outstanding obligations, default probabilities and final loss rates. These can be derived and calculated using analyses discussed in Chapter 5. Once the EL is known on a portfolio basis, lenders can use this to estimate more granular EL on specific products or customer segments. These estimates are used to set the price of the loan or lease, with interest rates or margins adjusted to cover EL (see Box 13 for a simple example).

Risk pricing is an industry norm for traditional lenders like banks and MFIs. But CGAP's experience indicates that AFCs are sometimes averse to accurately pricing in default risk, given low-income customers' sensitivity to price. While keeping prices low may promote higher sales and faster growth in the short-term, if pricing does not adequately compensate for risk then inevitable write-offs

will eat into profit margins and threaten the long-term viability of companies.

Although the overall EL does need to be priced in, this can be done in a nuanced, segmented manner. If a company has sufficient historical data and a robust assessment process, they may be able to put potential customers into 'less risky' and 'more risky' segments. Once this is done, they can price in the EL for that segment through an increased deposit, higher interest rate, or some combination thereof. Alternatively, companies could keep the price constant across customers, but change the percentage that must be received upfront.

Risk-based pricing, where some customers pay more than others, was generally perceived by our AFC partners as problematic, and likely to raise issues when customers discovered they had paid more than their neighbors. However, risk-based pricing is important in enabling financial service providers to lend to poorer, higher-risk communities (Klein and Okagaki 2018). Providers should begin experimenting with socially acceptable ways of pricing in higher risk, or they may find themselves gravitating toward less risky populations overall.

AFFORDABILITY AND SOCIAL ENTERPRISE

Much of the discussion in this section has focused on pricing, which is an important—albeit passive—way that AFCs manage risk. Socially-minded AFCs have a responsibility to keep prices as low as they can in order to make their products affordable to people who need them. This is one reason why some companies told us they did not invest heavily in credit departments or conduct thorough credit assessments: these would cost too much, making the overall price too high for poor customers. Other companies took an opposite approach, using longer tenors to spread their high-cost structures over several years.

Still, it is important to acknowledge that, at the end of the day, affordability is the product of a long-term emphasis on minimizing costs, including the cost of risk. Credit risk management can reduce the risk premiums that companies charge to compensate for high EL. More importantly, proper risk controls can reduce the volatility of an organization's losses. And it is those unexpected losses that can overwhelm price buffers and damage future profitability.

BOX 13. **Pricing in expected loss**

Fictional company SolarCredit wants to sell a new entry-level PAYGo SHS for $100, which would cover the cash price, cost of funds, operational expenses related to finance, and margin. But that price assumes no losses to credit risk. Analyzing the most recent data for similarly priced assets, SolarCredit arrives at an EL of 10 percent for the product.

To maintain the same margin, SolarCredit increases the price by 11.1 percent (or 1/(1–10 percent)) for all customers. The product will now sell for $111. This is a simplified example: increasing prices will also decrease demand, which needs to be taken into account.

Recognizing this, AFCs also have a responsibility to ensure that:

- They don't over-indebt clients.
- They minimize both the installment *and* the total price that clients pay.
- Clients understand the full pricing structure of what they pay for, including interest rates.
- They lend to clients that have the capacity to pay regular installments for the full term of the loan (this is particularly true of PAYGo, with its longer tenors).

In summary, there are always ways to make an asset cheaper. Yet some of these are more sustainable than others. Cutting costs on risk management or financing assets for too long may lead to short-term boosts in loan origination. But based on our experience, these loans are far less likely to turn into actual cash. And in the case of PAYGo models, this means more customers locked out from their assets and less impact. Companies need to consider and balance all of these considerations when designing products for their target customer.

CHAPTER 4

CREDIT TRANSACTION RISK

THIS CHAPTER FOCUSES ON *credit transaction risk,* the credit risk arising from an individual customer's repayment obligation. Credit transaction risk is measured by (1) the standalone probability that the borrower will not be able to meet their obligation as contractually agreed (probability of default), and (2) the ultimate loss in the case of a borrower default after depreciation of collateral, repossession costs, and other factors have been accounted for (loss given default, or LGD). More experienced risk managers will recognize the EL framework here in miniature. We explore this framework on a portfolio level in the next chapter.

To understand credit transaction risk requires going through each step of the credit life cycle and identifying actions that can avoid or mitigate this risk. The credit life cycle contains the steps shown in Figure 8.

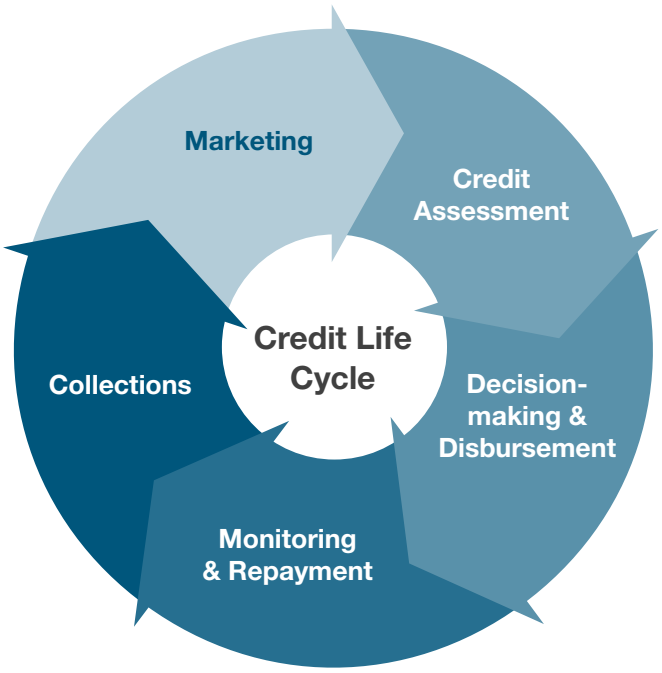
This cycle changes only slightly in asset finance, for which 'disbursement' requires the delivery of physical goods, some level of technical instruction, and often a physical installation. Also, the 'collections' process in asset finance can vary significantly from other types of credit.

As mentioned in Chapter 2, lenders need to start by developing clear policy documents and/or working procedures covering transaction risk at each step in the credit life cycle. These policies and procedures should clearly outline staff roles, responsibilities and tasks, and should be well-implemented in practice. Likewise, rules for handover of responsibility from step to step should be

SUMMARY

- Credit risk needs to be managed throughout each step of a credit transaction, from the moment a potential customer meets an agent until they have made their last payment.
- Compensating agents on sales volume can increase credit risk exposure. Taking steps to involve other parties or limiting their compensation for poor-quality sales can help balance this.
- Assessing the ability and willingness to pay for low-income, informal customers is the greatest challenge in asset finance today. Collecting large amounts of data over multiple loan cycles is a proven method for scoring clients but may not always be practical for smaller assets. Companies need to experiment with approaches that keep credit risk within stated appetites.
- Repossession (remote disconnection through lockout technology) is a unique tool in asset finance. Companies need to make their collection and repossession policies clear, then follow through on them while treating customers respectfully and with care.

FIGURE 8. **Credit life cycle**



formalized and expected timelines for each stage should be understood and benchmarks set.

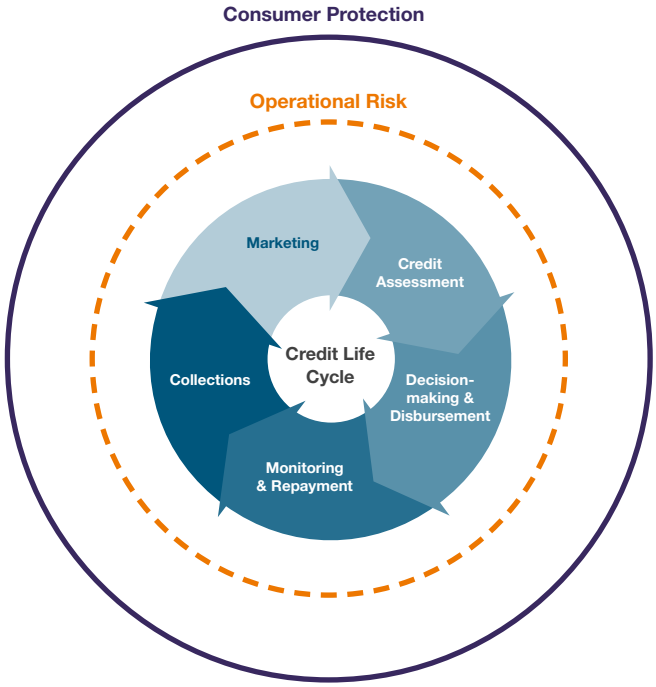
In short, it should be clearly stated and widely understood for each stage of the credit cycle:

- What is the task?
- Where is it happening?
- When is it happening?
- Who does what task?
- Why is it being done?
- How is it being done?
- How long is it expected to take?
- How does the customer transition from one step to the next?
- What information has to be given to the customer, and when?
- Who is responsible for initiating and completing that transition?
- Who has the authority to complete/approve that step?
- What documents or records in the IT system should be created at this stage?

In addition to each of these elements, this section also covers two important areas that fall outside of the formal credit cycle. The first is the most over-arching: *consumer protection.* This is broadly defined as the group of laws, procedures, and standards that safeguard buyers against unfair business practices. There are a number of useful consumer protection frameworks that companies may commit to, including the SMART Campaign[13] and GOGLA's Consumer Protection Code.[14] Yet for consumer protection to be effective, it must be internalized by a company and operationalized at each step of a customer interaction. Increasingly, financial institutions are explicitly integrating consumer protection as part of their risk framework by setting up roles and responsibilities for *conduct* risk management. In that spirit, consumer protection issues will be brought up throughout this chapter. The second is *operational risk management.* This plays an important role in driving or mitigating credit risk for AFCs, but is a wholly separate process whose full consideration is beyond the scope of this guide. However, it is referenced here in regard to its implications for credit risk.

In summary, our full view of credit transaction risk in asset finance is illustrated in Figure 9.

FIGURE 9. **Credit life cycle plus consumer protection and operational risk**



13 See https://www.smartcampaign.org/about/smart-microfinance-and-the-client-protection-principles
14 See https://www.gogla.org/consumer-protection

This chapter is organized around this framework, with each step along the journey covered in the following sections (several of which have been condensed for readability):

- Marketing, Origination, and Sales
- Credit Risk Assessment
- Decision-making and Disbursement
- Monitoring & Repayment
- Collections

4.1 Marketing, Origination, and Sales

The first step in the credit cycle is client attraction, or marketing. Defining a target clientele, who may be segmented into different profiles, is essential. For example, an institution may target low-income salaried employees, recipients of remittances and/or small businesses. Specific decisions could also be made to target women or customers in a certain age group. This exercise is closely linked to the setting of a company's risk appetite, as target clientele is also determined by a company's sales channels, mission and product offerings. (See Box 3 earlier for a description of one sales process).

Regardless of the marketing procedure, each customer must receive the following information prior to a purchase agreement:

1. Their contractual responsibilities, the consequences should they not meet them, as well as their rights and mechanisms for lodging complaints.[15]
2. A general technical introduction, including necessary maintenance requirements.
3. Information regarding their warranty and technical support.
4. A payment schedule, highlighting the portion of principal, interest, and fees/commissions, including any late payment fees.
5. Clear communication of the effective interest rate.
6. How the credit/application process will be conducted by the institution, to set clear expectations from the onset.

Contracts, as well as all of the marketing material above, should be written in easy-to-understand language (in the customer's native dialect) and gone through in detail with the client. Illiterate customers should be given special assistance, such as a video explaining the contract terms. The SMART Campaign as well as GOGLA provide good reference frameworks for customer care.

Transparency and clear communication are essential because customers who are sold an asset they cannot afford, or who do not fully understand the terms of a contract, are more likely to default. Ensuring transparency and understanding is part of the credit risk management process.

In the absence of clear communication, customers may get the impression that the transaction is similar to a cash purchase.

Therefore, the credit component, respective obligations and possible consequences in case of not meeting them (e.g., negative credit bureau entry, penalty interest, and repossession), must be explained as transparently and simply as this: "You are signing a commitment to pay X at Y intervals over Z period. If you do not pay, these are the consequences." In some cases, this frankness is avoided on purpose to not "scare the client." This is misguided. Transparency is even more important in the case of flexible PAYGo schemes, where customers may easily get the impression that they only need to pay when they want light or irrigation.

AGENT DYNAMICS AND COMPENSATION

Agents are the first, and sometimes only, personal contact that a customer will have with an AFC. They play a major role in mitigating credit risk, as do their incentives. AFCs often work with non-salaried agents who sell their products and originate loans in exchange for a commission.

Many firms we worked with use bonus systems to incentivize asset sales. These bonuses can be a key driver

15 Each institution has also to establish an efficient complaint resolution process, which should not only define responsibilities but also standard response times.

or mitigant of credit risk. For example, incentives that reward agents only on the quantity of loans originated will motivate them to simply 'move product' without regard for whether a client can repay their obligation. But if agents are asked to assess the ability and willingness of a potential client to repay the loan/lease, a significant part of the incentive should be tied to that actual repayment.

Most companies recognize this and structure their commissions to encourage high-quality sales. Others choose to limit agent responsibility to generating leads, leaving the responsibility for credit assessments to staff who follow up with interested customers using either a call center or in-person visit. Bonuses related to quantity and quality of loans originated usually make up a portion of those staff's compensation.

For companies that choose to incorporate agents into their credit assessment, there are various schemes that can help to incentivize quantity *and* quality of sales. Each have their own strengths and weaknesses. A well-designed incentive scheme should consider the following issues, as well as the trade-offs involved in emphasizing certain considerations over others:

1. **Portfolio growth.** Early-stage companies will want to grow the overall number of clients. This can be done by compensating agents for each new loan/lease originated.
2. **Portfolio quality**. Good repayment by an agent's clients should be rewarded, while poor repayment should lead to a reduction in commission. This creates an incentive for agents to follow up with delinquent borrowers and encourage repayment.
3. **Clear link between action and payment**. The agent should have no doubt regarding which outcomes will lead to compensation, and which will result in a reduction.
4. **Frequent and timely payment**. Companies will want to make payments frequently and on time, so that agents do not stop traveling or selling.
5. **Fraud**. When developing an incentive scheme, it is important to actively think about adverse effects/ misuse. How would you play or trick this scheme if you were an agent?
6. **Involvement.** Agents should be given the responsibility of interacting with the customer when payment delays occur up to a certain threshold (e.g., 30 or 60 days).

Box 14 describes two approaches we encountered in our work. There is no single 'right' commission scheme, but companies should always consider the principles. Regular trainings for agents, combined with well-established control structures that allow managers to identify and

BOX 14. **Sample agent compensation schemes**

a) Fictional company SolarCredit agent receives 50 percent of the commission when the sale is made, and the rest follows when certain customer milestones are met (25 percent after the first installment, and 25 percent after the second installment). This scheme is meant as an incentive to focus on financially healthy and trustworthy customers. However, it pre-supposes that an agent has more potential customers in their pipeline than they can actually serve—something which we rarely observed. Otherwise, the agent may still try to acquire every customer they can, hoping that each is going to be a "good" client.

b) The overall quality of an agent's past sales determines the amount of commission they receive from their next sale. An agent with a collection rate >90 percent for their 'portfolio' receives $20 for a new sale. Another agent with a collection rate <70 percent receives only $15 for a new sale, and a third <50 percent receives only $10.

This scheme incentivizes portfolio quality and is harder to manipulate. But it requires high levels of agent training and support, as the link between sales activities and received/unreceived bonus payments is harder to track. Agents with rapidly deteriorating portfolios are also unlikely to see an advantage in reaching out to clients, which could accelerate deterioration.

address any problematic agent behavior early on, are also critical to protecting customers and managing credit risk.

4.2. Credit Risk Assessment

Before any business sells a product to any client, it wants to know if it will be paid. AFCs are no different: they want to sell assets to clients who will pay them. A credit risk assessment is meant to evaluate a potential borrower's ability to repay the obligation, their character and willingness to repay, and any risks that may endanger repayment. This assessment tells the company how likely they are to be paid, which *should* inform the decision to finance a product or not, as well as how they will price the risk on that loan/lease.

In high-income countries, consumer credit assessments are often automated and rely heavily on credit reference bureaus. However, AFCs can rarely rely on these tools: even when reference bureaus are operational, few customers will have a record to analyze. In microfinance, creditworthiness is usually assessed through in-person interviews, reference checks and other high-touch interactions. But this often conflicts with AFCs' desire to keep costs low and use staff/agent time efficiently.

AFCs must strike their own balance between mitigating the risk of nonpayment and minimizing the cost of the mitigation. Often, the approach they take is heavily influenced by the size and type of asset being financed. The cost of more thorough assessments may be hard to justify for small assets with a low profit margin, while higher-value income generating assets and consumer goods may require different approaches to credit assessment (see Box 15 for an example of a tiered system).

This section focuses on the key principles for conducting credit risk assessments in asset finance. It covers:

- Willingness and ability to pay
- Credit scoring, and the difference between expert and statistical scoring
- Methods for streamlining assessments and verifying information
- The importance of secure data gathering and storage

The core assumption is that objects are being sold in-person, and that at least one interview of a potential borrower will be conducted. More complex assets may require additional interviews, home visits, technical assessments, and/or data requests.

WILLINGNESS TO PAY AND ABILITY TO PAY

In asset finance for low-income customers, a credit assessment is meant to establish two things:

1. **Willingness to pay**. Is the customer *willing* to meet their contractual obligations?
2. **Ability to pay.** Are they *able* to do that?

Where one or both of these elements are lacking, default is likely to occur. Under the constraints faced by low-income or poor households, willingness and ability to pay are often

BOX 15. **Different assessments for different assets**

upOwa finances solar products for customers in Cameroon and employs a tiered approach to customer assessment, offering three different SHS products of different capacity and pricing. Only the "premium" product requires a detailed customer survey, the outcome of which is used to fill out an expert-based scorecard. upOwa sees smaller products as an entry point for new customers who, if they repay, will have proven willingness and capacity and thus qualify for additional financed products. At the moment, upOwa just collects KYC information for these products; in the future, they plan to develop an automated risk-based scoring system for smaller units.

This proportional approach is found in microfinance as well. Customers who have successfully repaid their first, second, and third loan typically show low defaults on subsequent loans. Such a graduated approach adds a behavioral component to the assessment, replacing the credit bureau with the company's own experience.

closely intertwined. There is rarely a month in the life of a low-income borrower where each and every financial obligation has been met and significant money is left over. This is what being poor means. Even if one accumulates actual cash savings, this is the result of making real sacrifices in order to build up an emergency buffer.

If having the ability to pay means that clients reach each loan payment date with all other bills paid, all household needs met and a few hundred dollars emergency cash left over *after* making the loan payment, then most low-income borrowers would be excluded. Therefore, ability to pay almost always comes down to the discipline required to prioritize a loan installment over many other competing needs and wants. In other words, willingness to pay.

Assessing willingness to pay

For this reason, an important factor in assessing the credit risk in consumer loans is determining the moral character of the client. Moral integrity serves as a proxy for the willingness to pay even in the face of hard personal choices. This is both the most important factor to assess, and the most difficult.

There are many proxies for willingness to pay that an agent or credit officer can try to assess in the credit decision process. These could be factors that indicate stable life circumstances and responsible behavior: being married and caring for children, more life experience, living in a rural area with deep community links, are all good for stability.

Having some assets or owning land or a home can also be predictive of responsible, disciplined behavior. The question: "Do you own or rent the home you live in?", provides helpful indications. If a poor household at least owns the modest shelter they live in, that is an indicator of industriousness, discipline, responsibility, personal pride, and an aspiration to better one's life. These are often good predictors of honest and reliable borrower behavior.

Given the subjective nature of this assessment, it is vital that an organization's criteria should be as comprehensive and standardized as possible (and put in writing) to avoid the agent taking a decision/assessment based on their personal bias. Nor should any one factor be unilaterally disqualifying, unless the failure is so uniquely egregious that it necessitates rejection. Staff and agents should be clear on the policies and their importance, as well as the consequences of not following them.

Successful lenders can also try to cultivate willingness to pay among their target clientele through financial education. This can serve multiple purposes, as highlighted in Box 16.

BOX 16. **Tugende and driver education**

TUGENDE

Tugende finances motorcycles for taxi drivers in Uganda and Kenya. Their waiting list is long and understandably so — they enable drivers to own assets that they have rented all their life. One of the ways that Tugende assesses potential clients' commitment and creditworthiness is by asking them to attend educational sessions at the beginning of the application.

These sessions serve multiple goals:

1. Educate the client about Tugende's rules and procedures.
2. Help provide the financial education necessary for drivers to avoid overindebtedness.
3. Help to discipline the client by explaining repayment rules and penalties.
4. Provide the guide to safe driving and assets.
5. Serve as a filtering device. If potential clients do not have the discipline to attend and absorb an education session, they likely will not have the discipline to pay for a motorcycle for over a year.
6. Help to build a trustful relationship.

Measuring ability to pay

That does not mean that the ability to pay is not important when conducting credit risk assessments. Just because the ex-ante ability to pay is typically already marginal, this does not mean that it could not get worse. If ability to pay goes from marginal to impossible—if the cash simply is not there—then even the most willing and disciplined borrower will default.

Collecting income-related data that can be used to assess ability to repay is inherently difficult. Informal worker income is often irregular and comes from a number of sources, and as a result many customers struggle to provide reliable estimates of their earnings. In the absence of other methods for calculating income, self-reported estimates should be subjected to automated verification rules that flag, for example, when reported income is less than reported expenses. This can help agents or credit officers spot issues and dig deeper before making a decision.

Assessing ability to pay is not just about credit risk management. It is also about impact: this is the critical step that companies must take to avoid over-indebting clients (see Box 17).

But often an asset-based approach is easier to implement and more reliable than income figures. For example, home visits can be used to check on living conditions, the existence of motorcycles, TVs, smartphones, etc. The Poverty Probability Index (PPI) is an example of such an approach, and offers some promise as a tool in credit scoring.

BOX 17. Consumer protection in client assessment

One of the main goals of all common financial industry customer protection frameworks is to not overburden clients with debt. And one way that providers can protect against over-indebting customers is by conducting a customer affordability assessment.

The importance of credit assessments is discussed here from the institution's point of view, but the same is also relevant from the customer's standpoint. Correctly assessing a client's payment capacity does not only prevent the provider from losses but also the customer from becoming over-indebted. Social enterprises would do little for their social goals by signing clients to obligations that they are unable to fulfill.

The first customer contact should be always used to explain the purpose of the survey—in other words that the information collected will be used in the credit assessment process and to ensure that the terms of the loan/lease work for both the customer and lender.

CREDIT SCORING AND EXPERT VS. STATISTICAL SCORING MODELS

For ease of decision-making, most companies deploy a scoring model or 'scorecard' that enables various factors to be standardized and tabulated. These scoring models do not determine disbursement, but usually act as a factor in decision-making. However, the inputs and structure of that scorecard vary based on the maturity of the company, the nature of the asset, and the target client.

In general, there are two types of scoring models used in credit risk assessment:

- Expert-based models, where an agent or loan officer 'grades' the potential borrower on a number of pre-set criteria (asset holdings, income, character, references, etc.).
- Statistical models, where data is captured on various indicators, then an overall score is calculated based on historical predictors of customer default.

These two are not mutually exclusive. Both can be used in credit scoring.

Expert-based scoring

For early-stage companies, an agent or credit officer (the 'expert') will typically collect data and calculate a score based on their impressions and experience. This score and the collected data should be checked by at least one centralized credit analyst who is not financially motivated (an example of the Four Eyes Principle at work).

As companies grow and collect more data, they can begin to run regression analyses on customer data to identify patterns and relationships between variables. This can be

used as a plausibility check, revealing dependence between variables like family income and asset ownership, which in turn can flag applications where reported values deviate from past experience.

Statistical credit scoring

Once sufficient data has been collected, companies can go further and run regressions comparing customer data to portfolio data in order to isolate variables that are highly predictive of repayment behavior. This should, over time, enable them to build a statistical scoring model that can be tailored to their specific context and continuously improved upon as more and more data is fed into the model.

Statistical scoring requires the company to:

1. Securely collect a wide range of variables (quantitative, qualitative, and/or psychometric, although not necessarily all three together).
2. Store data in a well-maintained customer database.
3. Do so for a large enough sample of cases (rule of thumb >5,000, but the more the better) to be representative.
4. Gather data for long enough to observe outcomes (i.e., complete their loan cycles or default).
5. Hold key loan features more or less constant.

Developing an in-house scoring model requires a significant initial investment, including long interviews and in-person visits. However, this investment can have a significant long-term return. A good scoring model can reasonably predict the likelihood of default, limit the number of data points collected to only the most predictive, enable remote assessments (e.g., phone interviews, submission of pictures), and automatically flag inconsistencies that require physical verification. Statistical scoring is also an important use case for machine learning. Though the developed algorithms may differ, the same methodology is generally applicable regardless of context.[16]

It is up to each institution whether to use their algorithm as the main decision-making tool or simply as a supplemental input (e.g., in addition to a basic financial analysis), to come to the final credit decision. Scoring is not an end state, but rather a process. When done right, a good scoring model typically improves its performance with each loan cycle observed. Therefore, having an efficient, secure data collection process is the pre-condition to develop a statistically proven algorithm in due time. In other words, both quantity and quality of data matter, as does patience. Lastly, while reliance on algorithms and machine learning can increase with time, it is important to first develop internal capacity and set up strong management and governance frameworks. Without these structures in place, technical innovations will not deliver their full value.

DATA

Credit is a data-driven activity, and so the importance of a well-elaborated data strategy cannot be overemphasized. Establishing a thorough data collection strategy, requires answers to the following questions:

1. Which data to collect?
2. Which format – e.g., date, integer, string from dropdown, etc.?[17]
3. How can data entry be managed to minimize the need for future cleaning? For example, managers can add rules to date of birth fields that reject any entry falling between 18 and 75 years prior to the date of entry (i.e., a potential client must be between 18 and 75 years old).
4. How to collect data and when?
5. How to verify data?
6. How to protect personal and sensitive data?

When prioritizing the data to collect on customers, assessors should first focus on data that are minimally invasive, can be easily collected and are difficult to falsify. Socio-demographic indicators are a good example of such data, including age, gender, number of children, and time spent in an area.

A provider can and should collect the same data points for each customer, and they should do so directly into a digital system with a forced set of responses for each

16 E.g., collection scoring, predicting follow-up loans, measuring the success of marketing campaigns, etc.
17 Free strings are not recommended, as they are hard to code into modalities later on, although they are sometimes necessary, e.g., name and surname.

question. Over time this will result in a comparably large database, showing the same elements for most customers. Such a database is a key resource for data analytics and data-based risk management tools, and should be accompanied by a data dictionary that describes each variable, its derivation and its intended use (see Annex 4).

Typically, data storage capacity is not a limiting factor, especially not in IT-driven companies like many newer AFCs, who typically rely on cloud storage. Most of the assessed companies had a strong IT environment in place, enabling them to record and analyze complex datasets and visualize them in dashboards and trends.

GATHERING AND VERIFYING DATA

Many AFCs in our work were skeptical of the value of self-reported information from customers. This skepticism is understandable: income and expenses, details about one's family and lifestyles—these are sensitive topics for anyone. Executives at companies were also worried about agents 'coaching' clients to give 'correct' responses to questions.

These concerns are important, but they can be partially addressed. The following strategies are employed by effective financial institutions in order to gather customer data and verify its accuracy:

- Have someone besides the selling agent conduct the data gathering. Ideally this would be a credit officer conducting an in-person visit; more likely it will be an analyst on the phone.
- Ask borrowers for both references and guarantors. The former will provide insight into their moral integrity.
- Review credit bureau records (if available), allowing providers to check not only customers' repayment history but also their truthfulness about their self-reported loan history.
- Incorporate logic checks into the scorecard (see Box 18) which compare different information points and examine for plausibility (e.g., stated income minus stated expenses should roughly match the stated saving rate, which should match household assets, etc.).

BOX 18. **Verifying credit information**

PEG Africa is an AFC in West Africa. CGAP's work with PEG Africa revolved around designing a credit approval process for larger assets, such as solar water pumps. This included three stages of assessment:

1. Initial sale and interview
2. Technical assessment on-site
3. Follow-on credit interview over phone

The multiple interviews, including on-site visit, not only allow PEG to build up a firm view of the client's living situation and asset holdings. They also provide an opportunity to verify answers given to prior questions.

For example, during the initial interview customers are asked about the crops they grow, and in what acreage. Using government data on average crop yields and prices, we were able to build plausible estimates for expected income from an acre of a given crop. Significant deviations from those estimates (e.g., a tomato farmer who is also a self-declared millionaire) will raise follow-up questions.

Similarly, the on-site visit will enable PEG to assess the client's assets visually. When combined with PPI data, this can also hint at income levels. If the on-site visit reveals a different living standard, or different farm conditions, this could affect the ultimate score.

The use of available data, multiple interviews and interviewers, and on-site visits are all helpful. But the model will still require multiple iterations and loan cycles to get right. The best time to build it was five years ago. The second best time is now.

Importantly, the algorithm should not be a black box. Clear policies are needed for updating, evaluating, and re-calibrating the algorithm, all of which consider the actual outcomes produced and their impact. However, its internal logic should not be too widely revealed to frontline staff, nor every question equally weighted. A bit of mystery goes a long way in reducing potential 'gaming' of the algorithm.

One way of doing this is to include several psychometric questions (e.g., "how often do you think suppliers cheat their buyers by overcharging or under-delivering?") into the questionnaire. Metadata (e.g., how long did a customer take to answer a given question) should also be evaluated as part of the assessment, as it can be highly useful and may have predictive power.

STREAMLINING THE CREDIT ASSESSMENT

For smaller asset classes, a process such as that shown in Box 18 may not be possible or even necessary. Indeed, PEG does not follow this same process for all clients - lower-value assets require fewer interactions. Providers should explore ways of conducting assessments and gathering KYC data remotely and make use of local referees wherever possible.

4.3 Decision-Making and Disbursement

The credit assessment informs a credit decision that is taken post-assessment by the person or algorithm empowered to do so. This section covers the possible outcomes of that decision, as well as the management of risk in the organizational setup around credit decision.

APPROVAL OR REJECTION: MOVING BEYOND A BINARY IN ASSET FINANCE

Once the assessment is complete, companies must take the most important step in asset finance: decide whether or not to give the customer an asset on credit.

In CGAP's experience, companies leasing larger assets (e.g., vehicles) manage to filter out many unqualified applicants through their process, and still reject a significant portion of finished applications. On the other hand, companies financing smaller assets tend to have looser criteria: the majority of potential customers who can pay the deposit are approved.

Credit decisions should be based directly on the risk appetite and tolerance of the company. However, companies should not overestimate their ability to control repayment behavior post-decision. The most important place to manage credit risk is before it begins (in other words, pre-disbursement). Practically, this means that not every person who wants an asset should receive one on credit. **A large part of risk is knowing when to say 'no.'**

That said, companies who are loath to reject willing customers may want to consider risk-pricing their deposit. Asking those clients who are assessed to be riskier to pay 30 percent upfront as opposed to 20 percent, for example, may serve three purposes: (1) decrease the probability of default by filtering out higher-risk clients, and (2) reduce the exposure at default (EaD) for those who still want the asset.

MECHANICS OF DECISION-MAKING

A given staff member will generally be empowered to make credit decisions up to a certain limit (the more senior the staffer, the higher the limit). Significant exposures may require a vote of a credit risk manager, and exposures that could materially affect liquidity or solvency may even need board approval.

For companies financing higher value assets, decisions are often taken in a committee that consists of 2–3 voting members. One member could be the client relationship manager or credit analyst, while another member could be from the risk function.[18] Each voting member should be required to sign a decision and briefly state the reasons for their vote. This ensures commitment, transparency and traceability.

18 If the risk management representative's presence is leading to a significant number of rejections, companies may think about installing a process for business managers to escalate the decision to the top management or board level. Internal control and audit would then review the performance of overruled credit decisions.

For companies financing smaller assets, it may be more practical to rely on a tested scoring algorithm, to hold quick online committees or to allow credit officers to approve individual loans and use committee meetings to review these approvals periodically.

If a scoring algorithm is used it should be clear and formalized that the risk department owns that algorithm. This means that they regularly (preferably annually) back test it, update it and define then implement expert overrules when necessary (e.g., in crisis situation). Cases decided by a scoring algorithm should not be exempted from audit checks, which may include a review of data collection as well as the execution of proper back testing and model calibration.[19]

DISBURSEMENT

In asset finance "disbursement" means physically handing over the asset to the customer. Sometimes this may require an installation in a remote place (e.g., solar pumps), which also offers an opportunity to conduct some final verifications as suggested above. This has an indirect operational risk: if it takes too long to deliver and/or install an asset, it is reasonable to assume that a customer may be more likely to default. This would typically apply more to productive assets, especially those tied to seasonal use like water pumps purchased to irrigate crops.

4.4. Monitoring & Repayment

Once an asset has been installed, the goal for a company is to keep the customer paying on (or ahead of) schedule until the obligation has been completed. This is accomplished through regular and pro-active monitoring of the client.

MONITORING

Credit monitoring is done to ensure that in the borrower's daily battle of balancing priorities under tight financial constraints, the credit payment comes first.

If done properly, monitoring serves two objectives: (1) maintaining the borrower's willingness to pay and (2) finding out early if the financial situation of the borrower has deteriorated and is threatening their ability to pay. The first is the more important rationale: monitoring reminds the client that they still have an obligation, that the company (or even better, the relationship manager) will be personally disappointed if an installment is late, and that severe consequences and additional costs will follow if a loan falls into arrears.

In asset finance, monitoring should entail three main components:

1. **Regular notifications (through calls or SMS) of upcoming or recent payments due.** Such notifications should be triggered automatically by the credit risk management system, and should highlight consequences if the payment is not made.[20]
2. **Physical monitoring of the device.** Though this essentially refers more to operational risk management, it is highly recommended to establish mechanisms that allow lenders to track an asset's location (e.g., GPS tracker), as well as its proper functioning. This can help to mitigate reputational risk, as well as fraud and theft.
3. **Personal check-ins with the client.** Ideally done in person, but over the phone is also an option if necessary. These check-ins help identify emerging risk factors in the personal life or business. They are also a great chance to inquire into the customer's further needs and satisfaction with the offered service.

Scheduling and implementing this monitoring requires a MIS that is able to trigger notifications, identify clients for check-in, and flag cases that need attention. That system must also be able to track the payment status in (almost) real-time and calculate due dates and amounts. A well-integrated call center function is also crucial in credit monitoring.

19 The systemic risk of a scorecard-based credit decision is that the algorithm performs poorly. At development stage that can be tested quite easily with the help of a test set, which was not used to train the algorithm. However, model performance can also decrease over time, as customer profiles/behavior or environmental factors may change. That is why regular back testing and model calibration is so important. The audit's role here would not be to test the formulas themselves but rather to ensure the back testing is performed regularly (at least once per year).

20 Flexible PAYGo schemes are not immune from this requirement. Independent of how flexible the payment is (e.g., when working with what often is called "grace days"), each customer shall be notified when they are close to missing a contractual obligation.

Every monitoring action, whether regular or ad hoc, should also result in an update to the client's rating/score. This provides additional data to study and use when developing early warning indicators.

REPAYMENT

For clients who are in repayment, we recommend establishing an easy-to-understand payment schedule with equal installments over a contract's lifetime. An exception may be highly seasonal activities such as agriculture or tourism.

Whenever possible, cash collection should be discouraged (better forbidden) to mitigate operational risk associated with theft or fraud. More secure options such as mobile money, internet banking, branch payments and/or bank transfers are preferred. However, companies need to ensure that the method of payment is understandable and easily accessible. For example, one should not rely on mobile money when there are no nearby agents, as customers may struggle to pay even if they are willing and able. Likewise, ensuring that customers understand how to make payments (for example, how to initiate a mobile money payment) is important to mitigating credit risk.

4.5 Collections

No matter how high-quality an asset is, and despite all of the work outlined in this chapter and the ones preceding it, some clients will fail to pay on-time for their product. At the end of that first day (Day 0), the client is officially delinquent. This is not an emergency—in fact, for many companies it may be the norm. Most clients will typically pay within a few days and require little in terms of follow-up. But as the days tick by and more payments are missed, the likelihood of the client eventually paying begins to diminish and a write-off become an increasingly probable outcome.

It is the job of 'collections' to avoid that outcome. This is accomplished through a progression of increasingly serious actions that are explicitly defined by the organization's Collections Policy (part of the policy framework described in Chapter 2). Each of those actions has the same basic goal: getting the borrower to pay as much as they possibly can while avoiding or minimizing any loss for the lender.

Collections is arguably the area in which asset finance differs the most from traditional microcredit. The 'asset' in asset finance is its own collateral. Instead of hounding clients for pennies on the dollar or pursuing legal action to seize hypothecated collateral, AFCs can repossess the leased item and sell it to another customer with comparable ease. When combined with the ability to remotely switch off an asset, this provides AFCs with a powerful lever to enforce collections.

However, knowing when to use a given lever is a challenge for early-stage companies. This section covers:

- The process of escalation that can lead to an eventual repossession
- The mechanics, rationale and math behind repossessing an asset
- Alternatives to physical repossession, such as lockout technology

Escalations

Credit escalations are steps in the process of getting ever more serious with a delinquent or defaulted client, with the goal of having them pay off their arrears and resume regular payment. These steps can escalate from automated SMS to voice calls to home visits to repossession to legal action, and may include many steps in between.

For almost any AFC, the first steps will be to remind the client that a payment date is at hand or just passed, and to find out why they have not paid. Early-stage actions may then vary depending on the client's risk profile and repayment history. This is why AFCs need to regularly update their data, and use that data to segment clients by the degree of risk they represent. For less-risky clients, it may be sufficient to get a 'promise to pay' or even think about rescheduling, while for riskier clients it may be necessary to schedule a home visit.

The challenge with escalations is that while more serious actions (such as house visits or repossession) may be good ways of collecting value from an outstanding asset, they are also expensive and time-consuming. This is why segmentation is so important—it allows companies to prioritize collections actions by risk segment.

As clients move through various stages of escalation, the person responsible for engaging with the client may change as well:

1. **Early-stage arrears** may be managed by the staff member or agent who originated the loan and who has a financial interest in keeping the client in good standing.
2. **Moderate risk clients** could also be reached by the company's call center, who may want to obtain a promise to pay and explain future steps, including repossession.
3. **Higher risk clients can** be handled by a specialized collections team who may conduct additional calls or visits to push for an amicable arrangement. This could include rescheduling or even partial forgiveness of the loan to get a borrower back on track.
4. **Repossessions** may be handled by the same team or by a different group of specialists. At this point, nothing short of a major payment should suffice to prevent repossession.
5. **Legal action** Where repossession is not feasible, the final stage is often outsourcing collections to a law office, collections agency or a specialized subsidiary of the lender. This may also be the time to report a client to the credit bureau (see Box 19).

Splitting out the tasks in arrears management and collections among different units as above also makes it easier to measure the performance of each team and avoid "perverse incentives."

For reasons of consumer protection and reputation, all of these tasks as well as the people responsible for them, the timeframes and the suitable code of conduct, must be explicitly laid out in a Collections Policy. This is an area particularly vulnerable to abuse, so being clear about collection policy and auditing the actions of collections staff is vital.

Contracts should clearly highlight the company's right to switch off or repossess an asset, as well as the precise terms under which they would do so (e.g., after 90 days consecutive nonpayment). Contracts should also be explicit about the criteria for reporting clients to a credit reference bureau. They should also clearly communicate the customer's rights, as well as the mechanism to deal with customer disputes, including requests for corrections or updates to account information.

Case studies of three different AFCs' escalation strategies are seen in Box 20.

BOX 19. **Credit reference bureaus**

Independent credit reference databases play important roles in financial inclusion:

- They allow providers to look-up new borrowers to see what loans they have outstanding and how they have paid in the past.
- They are a mechanism for clients to leverage good repayment behavior into additional credit for home/business.
- They are a means of enforcing discipline on existing borrowers.

This last role can be a useful lever for AFCs, who have few other mechanisms to legally and ethically nudge a borrower to repay. But providers will want to make sure that negative marks are eventually cleared from a credit file to avoid inadvertently contributing to financial exclusion.

Repossession

In theory, the decision whether or not to repossess a defaulted asset should be a question of straightforward math:

- What residual value does the asset have?
- How much is a repossession likely to cost (staff time, fuel, warehouse space, etc.)?
- How much value has historically been recovered in resale of similar repossessed assets?

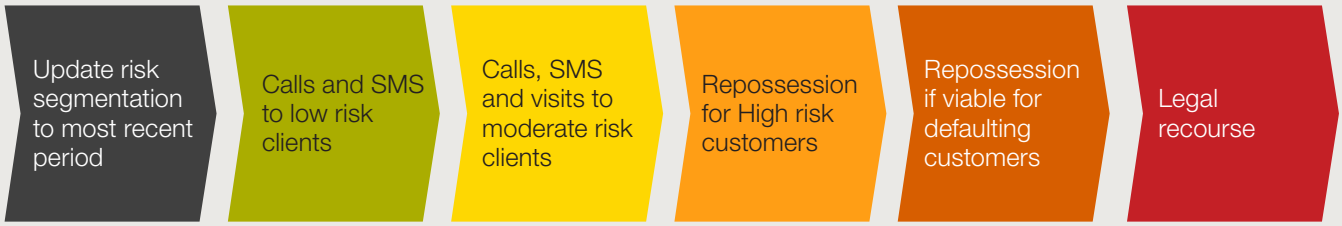
However, there are complicating factors to consider. First is the signaling effect. For many lower-value items, or assets in the later stages of repayment, repossession may appear uneconomical on its face, as the remaining value of a used asset may be low and the asset resalable only at a steep discount, if at all. Yet no one should underestimate the signaling effect of collection actions in general, and highly

BOX 20. **Case studies in repossession**

uPowa uses lockout technology to motivate repayment, but sought to define a collections strategy beyond lockout that could simultaneously recover the most value from its outstanding portfolio, while also maximizing resources available (sales agents, call center and collections agents). With the help of CGAP, they arrived at a data strategy where clients were segmented from 1 (lowest risk) to 8 (highest risk) based on a number of factors, including the number of days they had missed since origination and the number of days since their last payment. Collections activities were then prioritized according to that segmentation:

1. Clients in 1–4 are to be handled by call center and sales agents
2. Clients 5–6 are to visited by collections agents
3. Repossession is to be considered if viable for Clients in group 7, and conducted for clients in 8

This new strategy required 80 percent of clients to be covered by call center and sales agents, and for the last 20 percent of clients (candidates for repossession) to be handed off to collections agents. Implementing this strategy also required regular data updates and improving the call center functions.



		Days since last payment						
		1–30	31–60	61–90	91–120	121–150	151–180	181+
Days in arrears (behind contract)	Current	1	1	2	2	3	4	5
	1–30 days	2	2	3	3	4	5	5
	31–60 days	3	4	5	5	5	6	7
	61–90 days	4	4	5	5	6	6	7
	91–120 days	4	4	5	6	7	7	7
	121–150 days	5	6	6	7	8	8	8
	151–180 days	5	6	6	7	8	8	8
	Beyond 180 days	7	8	8	8	8	8	8

EFTA is a leasing company operating in Tanzania that finances larger business assets. When an EFTA lease has been written off in their financial system, that customer's asset will be repossessed. The customer will have by now been issued with a series of verbal and written warnings, and lastly, as a final resort, a repossession warning letter. An investment officer (loan officer) will then write an internal repossession recommendation form outlining the reasons why they believe this step must be taken. The form is reviewed and signed off by their branch manager and the COO. Upon approval, two officers will move ahead with the repossession, ensuring that the requisite technicians and transporters have been hired to take care of the operation.

The equipment is then transported back to the supplier's premises or to an EFTA warehouse for storage pending resale. A repossession form is completed by the Investment Team to document that all equipment was recovered and that it was done safely and following protocol. This is reviewed and signed off by the COO.

BOX 20. **Case studies in repossession** (continued)

TUGENDE

Tugende uses partial and complete asset impounding. Partial impounding (their term for lockout) is applied to the clients from 1 to 7 days in arrears and serves to motivate the client to repay the lease while the outstanding balance is still manageable. Complete temporary impounding is considered for clients who have not communicated their challenges and are not making efforts to pay off their arrears.

If arrears go beyond 15 days without communication and payment, the collections team considers repossession. Assets repossessed by Tugende are first assessed for quality / upkeep and, if possible, made available to new Tugende clients as one of the range of used vehicles it offers for sale on the secondary market through the partner companies.

visible repossessions in particular. Assets are often financed in marketing campaigns across a limited geographical area. The contagion effect of *not* pursuing repossession among clients in the same community is a real risk, and word travels extremely fast. If companies do not stick to their communicated policies on repossession, clients will know.

Second, the monetary flows related to repossession need to be valued on a net present basis, meaning that all expenses and inflows occurring after the default should be discounted back to that date using the effective interest rate as the discount rate (for information on how to calculate NPV flows, see Annex 5). The reason for this is to account for the true cost of default, which includes both the *actual* and *opportunity* costs. If the asset were resold one month faster, that payment could be invested earlier, typically into the same asset class (i.e., another lease contract), hence earning the same interest. Repossessed items typically take some time to turn into cash (see Box 21 for a hypothetical example).

In our experience, many defaults occur relatively early in a repayment cycle, while assets still hold significant value. Companies should prioritize these assets for repossession, as this will decrease their LGD. Also, repayment issues early in a contract are likely a sign that a customer has been oversold or does not value an asset. It may be best to act quickly, within the stated terms. Repossession decisions should follow clear, documented policies. They should not be left to the ad-hoc discretion of customer service teams.

That said, the negative concept of repossession does not have to be the reality. Even when involuntary, repossessions should be done respectfully and with tact. But various AFCs have also found 'voluntary repossessions' to be a useful tool. In these cases, clients are allowed to return an asset when they are struggling to repay and to receive their initial deposit back, either partially or in full. Such offers cannot extend too long past the date of origination. But they can provide relief to customers, minimize costs and maintain reputation.

A final point to consider is that secondary markets for valuable assets are historically an important channel for reaching poor customers. Every asset that can be repossessed and redeployed has a chance to help families who otherwise could not afford it. The more that companies can invest in their ability to refurbish and redeploy assets (particularly income-generating ones), the more social impact they can unlock.

Lockout technology

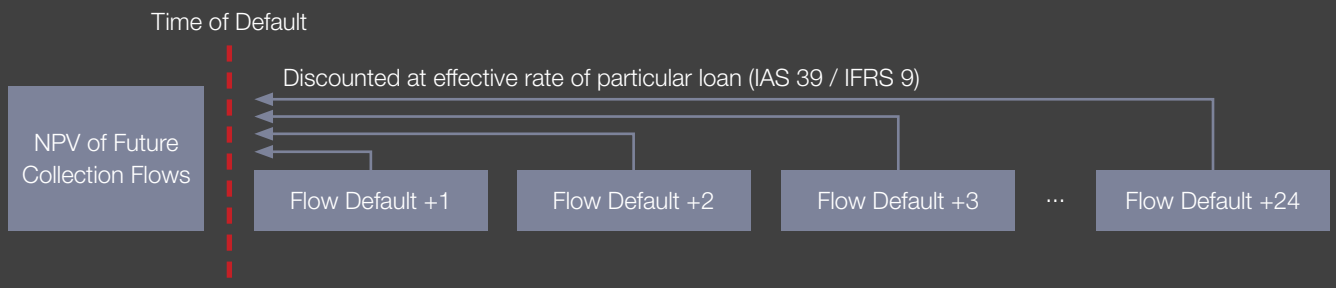
Much has already been written in this guide about the utility of lockout technology. It is a potentially powerful tool for risk management, although it has limitations.

Remotely locking a device is, in effect, a 'soft' repossession, and should occur within the same documented frameworks that are clearly understood by agents and clearly communicated to potential customers. But once these are communicated, they must be followed through on: it is equally important to enforce a lockout and other steps as it is to stipulate them in the contract.

For a defaulted customer whose asset has been switched off, or for a customer who is making regular payments but at a rate below the acceptable threshold, companies

BOX 21. **SolarCredit repossessions**

Jon defaulted on his solar water pump from fictional company SolarCredit six months ago, with an outstanding balance of $1,000. Three months ago, SolarCredit collected $300 in cash. Today the system was repossessed, which cost SolarCredit $50 in total. From experience SolarCredit knows the repossessed system's value to be $500 and expects it to sell in one month. The effective interest was 30 percent per annum. What is the expected NPV of the recovered value?



Time value of recoveries:

$$\frac{\text{(+/-) Cash Flow 1}}{(1 + \text{Eff.APR})^{\frac{\text{\# Months since default}}{12}}} \quad \text{(–/+)} \quad \frac{\text{Cash Flow 2}}{(1 + \text{Eff.APR})^{\frac{\text{\# Months since default}}{12}}} \quad = \text{NPV}$$

$$\frac{300}{(1 + 30\%)^{\frac{3}{12}}} - \frac{50}{(1 + 30\%)^{\frac{6}{12}}} + \frac{500}{(1 + 30\%)^{\frac{7}{12}}} = \$666.15$$

must decide whether or not to physically repossess the asset. For clients who have defaulted in the first 50–65 percent of their contracts, repossession is recommended, as it maintains the signaling effect described above, recovers some value and prevents local mechanics from 'jailbreaking' the asset. Knowledge diffuses quickly: give enough clients enough time, and they will figure out how to disable lockout technology.

THE IMPORTANCE OF DATA IN COLLECTIONS

As with other aspects of credit risk management, collections can be vastly improved by data analysis. It is important to study the reasons why clients default, as this can allow providers to correlate them with successful workout strategies. This may also improve default prediction power over time, eventually becoming part of the credit scoring algorithm.

Just as important is to study the efficacy of various interventions, including remote lockout:

- Which customers start paying again after their first, second, or twentieth lockout?
- After how many lockouts does a defaulter typically default? Can this be predictive?
- What is the average repayment boost from an SMS vs. a call vs. a visit? How should those be deployed?
- Do repossessions increase the overall portfolio quality in a given area?

CHAPTER 5

PORTFOLIO MANAGEMENT

WHILE THE PREVIOUS SECTION discussed the management of credit transaction risk, this chapter focuses on portfolio monitoring and management. As stated in Chapter 2, every lending institution needs to accept a certain amount of credit risk. This is articulated in its risk strategy, tolerance and/or appetite statement. The objective of portfolio management is to monitor and ultimately ensure that operations stay within the accepted risk boundaries.

A lender can be almost certain that some of its borrowers will fail to repay their obligations. It is (or should be) easy for a company to state how many borrowers *have* defaulted and what losses occurred as a result. But risk managers have a much harder task: they need to project, with as little uncertainty as possible, how many borrowers are likely to default in the future and how much the company will lose if they do.

These are questions of risk, and risk is always future-looking: once something bad has happened it is not a risk anymore but an actual, unfortunate event. The quantification of risk is also future-related, with unknown events and developments making it impossible to predict with perfect accuracy. However, what is possible is to quantify the *probability* that a given risk will materialize, as well as the likely impact should it come to pass. This reduction in uncertainty is the role of portfolio management.

This chapter covers the following aspects of portfolio management:

- Key terms and concepts
- Measuring portfolio performance
- Portfolio analysis
- Concentration and diversification
- EL and unexpected loss in risk management
- Monitoring and dashboards

SUMMARY

- The management of a loan portfolio and its collective credit risk depends greatly on how a company measures and analyzes portfolio health.
- The EL framework is a valuable way to measure past losses, estimate future ones and price those into the overall cost of an asset.
- As a reaction to more flexible payment schedules in asset finance, traditional PAR metrics are being re-imagined. Metrics such as collection rate and receivables at risk can add critical nuance to portfolio analysis.
- Fast-growing companies must be careful not to rely on portfolio averages, as new loans tend to pay better. Rather, they should include vintage curves and transition matrices in their regular credit analyses to understand how risk is evolving over time for monthly cohorts.
- Analyzing a portfolio by geography or product type can yield valuable insights and help maintain diversification, so that the portfolio does not become concentrated in one area or sector.

5.1 Key Terms and Concepts

ARREARS

The term *arrears* refers to payments that were expected and obliged but have not been received. Simply put, the payments that are late. Borrowers are classified as 'current' if they have made all of their payments at a given point in time. If a payment has come due but not been made, they are said to be 'in arrears'. If borrowers pay the amount due (plus any penalties or fees that may have accrued), they are once again 'current.' They may then stay current for the remainder of their obligation or end up in arrears again.

Once an exposure has been in arrears beyond a certain limit of days, it will be classified as a non-performing loan. This label indicates that a company is no longer expected (by most accounting standards) to accrue interest, and that only payments on interest already accrued shall be recognized.[21] When an exposure is further in arrears, it should be fully written-off from the portfolio as will be discussed below.

In loans or leases with fixed monthly payment schedules, arrears are the total amount that has come due but has not been paid at the time of evaluation. In flexible PAYGo approaches, the definition of arrears is subjective. PAYGo arrears could be viewed as the difference between the nominal amount of payments that should have been received on a date (e.g., $10 after 40 days of a solar lease that costs $0.25 a day) and the amount that has actually been received. However, the PAYGo model is unique in that it never requires these arrears to be settled.

WRITE-OFFS

Write-offs can be used as a shorthand for actual credit losses, but the term refers to an accounting procedure. If at some point after disbursement it becomes clear that a borrower will never repay in full then the value of the asset (the loan receivable) has reduced. This reduction in value must be accounted for, and that accounting step is called a 'write-down' or a 'write-off' (see Box 22 for example).

BOX 22. **SolarCredit write-offs**

An agent from fictional company SolarCredit sells an SHS on credit. They enter this sale into SolarCredit's database along with proper documentation. SolarCredit's accountant now initiates several balance sheet actions:[a]

1. She credits (reduces) the Inventory account by the principal amount of the loan (the face value of the asset), and debits (increases) Loan Receivables by the same amount.
2. She debits (increases) the Expense account by the amount of EL, and credits (increases) Provision for Bad Debts by the same amount. This is money meant to cover EL.

When the first few payments are received, the accountant credits (reduces) the Loan Receivable, and debits (increases) Cash. But unfortunately, the borrower quickly defaults, and after multiple efforts SolarCredit decides that they will never be able to collect more cash or repossess the asset.

At this point, the accountant credits (decreases) Loan Receivables, and debits (decreases) Provision for Bad Debts. This act of decreasing the Loan Receivables account is the actual 'write-down', as the value of that receivable is now recognized to be 0. Hopefully the Provision account is a sufficient buffer for this and other defaults (see later in this chapter for more detail).

a This example uses the 'allowance method' of accounting for loan losses. Different companies may use different accounting methods.

RISK APPETITE

As discussed in Chapter 2, a 'risk appetite' is a company's stated accepted level of risk exposure, articulated within their broader strategy.[22] This statement covers all major risks, which for lenders will include credit risk, and quantifies both the measurement of that appetite and

21 Note the shift from an accrual basis of accounting to a cash basis once the loan is declared non-performing.
22 For an in-depth discussion, see FSB (2013). For practical examples, see IRM (2017).

specific limits. A company might state its acceptable level of credit losses, expressed as the percentage of the total portfolio that will be 'non-performing' or 'written off.' As an example, one of CGAP's AFC partners has the following credit 'goal':

> "To develop and meet sustainable targets for the percentage of write-offs and recoveries to new loans whereby the [Non-Performing Loan] ratio should be <10 percent … [COMPANY] may set these targets lower from time to time to improve performance in the portfolio against these minimums. Non-Performing Loans are defined as any loans at over PAR 90."

A different company may choose a different goal or use the same metric with a higher or lower target. When setting these goals in asset finance, companies should always keep in mind their typical recovery rates on defaulted assets, and potentially even include specific targets for repossession and resale.

EXPECTED LOSS

EL is the average amount of credit loss that is expected to be incurred over a particular time period. The loss is measured as the *present value* of receivables that are not expected to be collected and therefore will be written off or otherwise expensed over the time period.

EL is the product of the probability of default (PD), the LGD and the EaD. For an example of how it is calculated, see Box 23.

$$EL = PD \bullet LGD \bullet EaD$$

The probability of default (PD) is the probability of a borrower to default within a specified period of time, typically one year.[23]

The EaD is the total balance owed by the borrower to the lender at time of default, and is expressed in monetary units (e.g., US$).

LGD is the *percentage of the EaD* that is expected to be considered lost, once it has been established that a default has occurred. The LGD is equal to 100 percent minus the percentage of EaD that will be recovered through liquidation of collateral and/or other post-default collection actions. As highlighted before, for the purposes of establishing LGD, the post-default cash flows from recoveries must be discounted back to the time of default at the original internal rate of return of the defaulted contract.

The following sections of this chapter elaborate on appropriate ways to quantify PDs, LGDs, and EaDs - and hence to calculate EL. But as EL is the product of three different variables, there is an infinite number of combinations to result in the same outcome. Using the example of SolarCredit, another company could reach the same EL result with a PD of 20 percent and an LGD of 40 percent; their EL would still be 8 KSH.

BOX 23. **Simplified EL model**

On December 31, a credit analyst for fictional company SolarCredit reviews their annual performance, and finds the following results for their only loan product:

- 10 percent of SolarCredit borrowers defaulted throughout the year.
- Their average exposure at the time of default was 100 KSH.
- On a NPV basis, just 20 percent of this exposure was (or is expected to be) recovered on average, so LGD was 80 percent of EaD (100 percent – 20 percent).

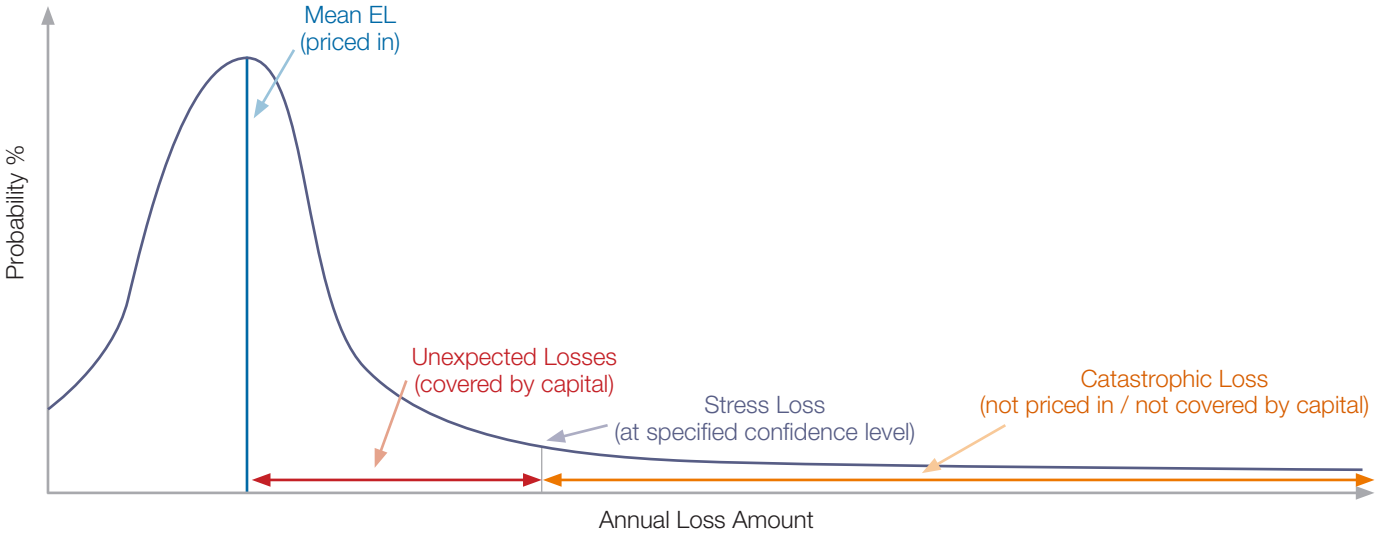
Based on this information, the analyst computed the EL to be:

$EL = PD \bullet LGD \bullet EaD = 0.1 \bullet 0.8 \bullet 100 =$ **8 KSH**

She then recommended that 8 KSH be provisioned for each loan expected to be originated in the next year, and that this amount be incorporated into SolarCredit's pricing as their cost of risk.

23 The PD is most often stated for a future period beginning immediately, but can also be expressed as a forward default probability beginning in one year for one year, for example.

FIGURE 10. **Probability curve of different loss levels**



AFCs are typically willing to accept higher PDs than typical MFIs, as they are usually able to achieve higher recovery rates based on asset repossession, and hence lower LGD. That strategy must be agreed upon and articulated in a risk appetite.

UNEXPECTED LOSS

EL are calculated based on historical performance and should be priced in and accounted for. However, actual losses may be less than expected, in which case the firm has higher earnings, or more than expected, in which case the firm has an *unexpected loss:* a yearly loss that is not really expected but generally possible to occur even under ordinary business conditions.

Unexpected losses can still be calculated, within a given confidence interval.[24] Common standards for confidence intervals range between 99 percent and 99.9 percent.[25] The sum of expected and unexpected loss can be used as reference for the minimum amount of loss-absorbing tier-1 capital. This is the 'Stress Loss' point.

The concept of Unexpected Loss is best illustrated in a chart like Figure 10. Portfolio credit losses typically follow a right-skewed probability distribution, the area below which sums up to 100 percent.[26] The first point on the X-axis (mean), which divides the curve into two 50 percent areas, is what we would *expect* the portfolio loss to be. Every point to the right of that would be unexpected (but possible). The farther to the right, the less likely the respective portfolio loss is going to occur, but the more devastating the impact would be.

SUMMARY

Credit portfolio management can be summarized as a set of policies, work processes, and tools to:

1. Monitor compliance with a company's expressed risk appetite
2. Predict future developments regarding the risk appetite, and identify (adverse) trends early
3. Suggest actions to mitigate credit risk in case the accepted risk is or will be exceeded
4. Account for occurred or likely-to-occur credit risk

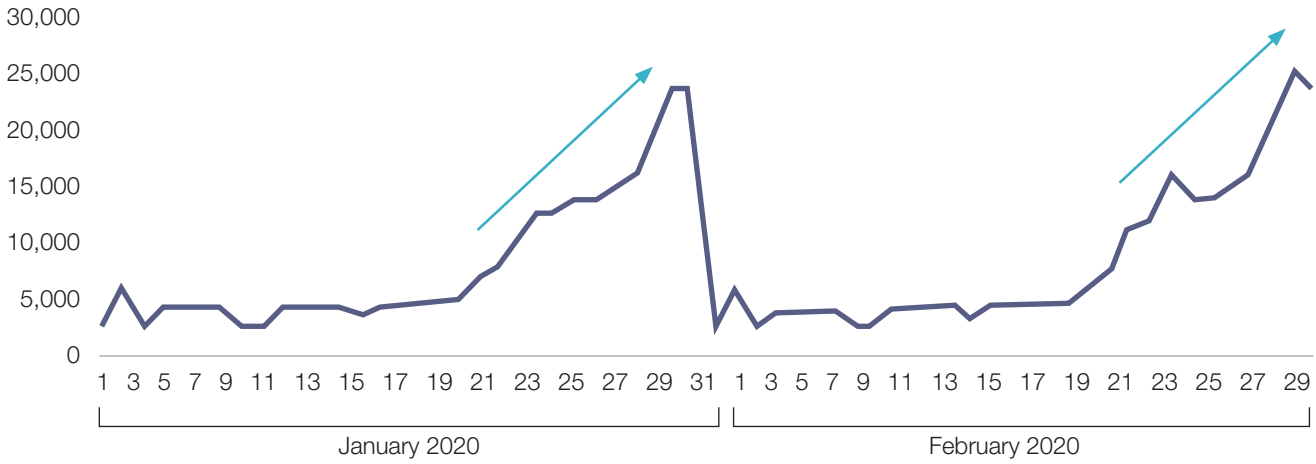
As may already be clear, portfolio management is an exercise in analyzing large numbers. It deals with shifts

24 Assume you flip a fair coin 100 times. The likelihood that you get more than 60 tails is approximately 2 percent. Or, in other words, with 98 percent confidence one would not get more than 60 tails.

25 A confidence interval of 99 percent implies that the yearly loss would not exceed X in 99 of 100 cases (i.e., years) – all else equal. However, the converse is that you should expect such a development once in a hundred years.

26 A portfolio credit loss is the sum of all individual credit losses over a certain period (e.g., one year).

FIGURE 11. **Portfolio growth over time**



in key variables over time of a portfolio made up of thousands (or millions) of loans/leases. How these shifts are measured is discussed in the next section.

5.2 Measuring Portfolio Performance

There are four main dimensions of portfolio performance that should be regularly tracked by a portfolio analyst and risk manager:

- **Growth**. How many loans/leases have been originated in the last period?
- **Arrears**. What percentage of the outstanding portfolio is owed by clients who are in arrears? What percentage of loans have been labeled as 'in arrears' for more than 30 days, 60 days, etc.?
- **Write-offs and recoveries**. What percentage of all originated contracts have been written off? What percentage of defaulted balances have been recovered?
- **Rescheduling**. What percentage of originated loans have been rescheduled? How quickly does the company reschedule loans? Is there an 'evergreening' effect?

All of these are critical for formulating a complete picture of portfolio performance. However, some are more complex to calculate than others, so this section will focus mainly on how to measure and monitor arrears, while also briefly covering growth and recoveries.

GROWTH

The speed (or lack thereof) that a company is growing its loan/lease 'book' is an important contextual factor for analyzing a portfolio. It is important to look for sudden increases in growth particularly for branches and officers (or agents) where fraud is possible, where there is growth in average loan size or where there is a strange surge in lending activities toward the end of each month (see Figure 11).

MEASURING ARREARS

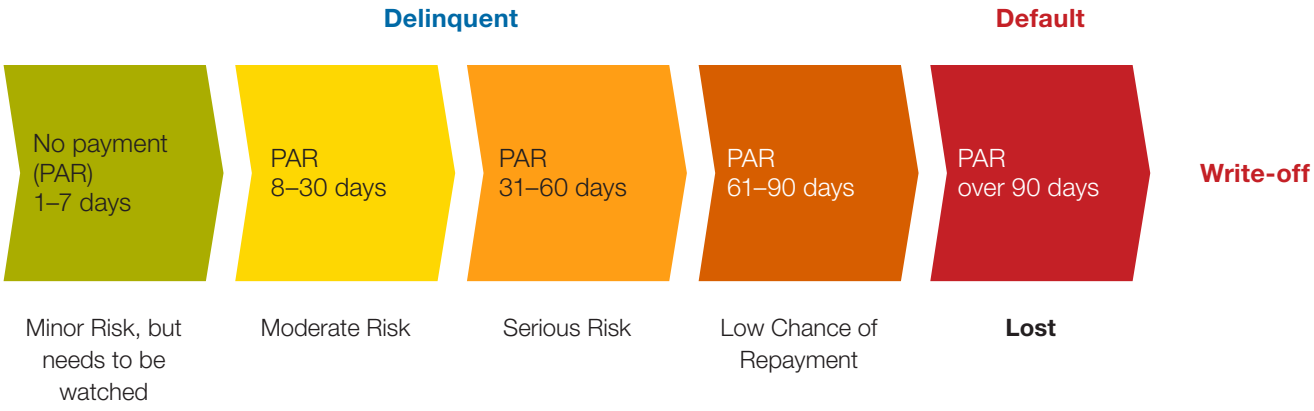
Measuring the amount of exposures in arrears in relation to the overall size of the portfolio ('who has not paid us, and how much are we owed?') is one of the key activities needed to measure portfolio health. Interpreting the arrears to estimate the risk level of the portfolio ('who is likely to never pay us again, and how much would we lose if they did not?'), then keeping that risk level within the stated appetite, is the more complex, probabilistic aspect.[27]

Figure 12 shows the journey of nonpayment from delinquency, to default, to loss. Because portfolio managers will be tracking this journey for thousands or even millions of loans, they need numerical indicators, or metrics, that quantify the percentage of their portfolio that is at various stages of nonpayment.

Metrics that track *delinquency* such as PAR ratio are

27 For an engaging and detailed review of portfolio quality metrics and their complexities, see Rosenberg (1999).

FIGURE 12. **Credit deterioration over time**



forward-looking risk indicators that risk managers use to predict the probability of progression to default and loss. A customer who has missed one payment is not guaranteed, or perhaps even likely, to miss a second or eventually default. But they will still have a higher probability of default than a customer who has missed no payments, just as a customer who has not paid for 30 days is more likely to default than a customer who has not paid for 3. As previously mentioned, the most common metric for tracking delinquency with traditional lenders is PAR. Collection Rate (with its various permutations) and Receivables at Risk are also important delinquency indicators for PAYGo lenders.[28]

A second set of metrics, such as 'nonperforming loans (NPL) ratio,' indicate *defaults* - that is credit events that have already come to pass. These tell a company what percentage of their portfolio is held by clients who have stopped paying for a sufficiently long time that the company can no longer accrue interest, should switch to cash-based accounting and consider initiating the recovery or write-off process. These loans are non-performing or in default; the company considers it unlikely that the customer will resume payment of their own accord.

Lastly, a third set of metrics, such as 'write-off recovery rate' and 'write-off ratio,' quantify the *results* of actual defaults: what percentage of losses were recovered and what percentage had to be written off as an accounting loss.

We shall discuss PAR, Receivables at Risk, and Collection Rate in more detail below.

Portfolio at Risk

PAR is a ratio that reflects a company's credit risk position at a specific point in time. The definition of 'at risk' depends on the number of days that are chosen for analysis, with PAR X defined as the total balance outstanding under any loan contract which is X number of days (or more) in arrears.

PAR is measured as:

$$\text{PAR\_X(\%)} = \frac{\text{Principal outstanding} > \text{X days late}}{\text{Total gross portfolio outstanding}}$$

Most commonly, X is set at both 30 days and 90 days to get a general impression of the credit risk position. These numbers are based on expectations of monthly payment; a customer who has not paid in more than 30 days has missed at least 2 monthly payments, while one who has not paid in 90 has missed at least 4. Therefore, on any given day that PAR30 is calculated, it shows the percentage of an outstanding portfolio that is owed by clients who are 30 or more days late on a loan payment. PAR90 would tell us the same information, but for clients who are 90 or more days late. PAR90 can never exceed PAR30, as every exposure falling into PAR90 must fall into PAR30, as well.

28 These and other metrics are discussed in far more detail in Khaki et al. (2021, forthcoming) and in materials that can be found on the PAYGo PERFORM website: https://www.findevgateway.org/paygo-perform/.

Thirty or more days in arrears is a reasonable alarm threshold where an institution may be seriously concerned about the potential default of the borrower. If a borrower moves to PAR90, the default has more or less materialized, and the account should soon be moved over to the collections team.[29] It is critical that the portfolio risk reports not only include the status of PAR but also of the development of write-offs. Some lenders might be tempted to write-off loans aggressively to affect the PAR ratio, and so sudden shifts in PAR ratio accompanied by simultaneous surge in write-offs should be a red flag if not instructed by the management.

Companies financing smaller assets or companies who expect more regular payments (e.g., daily or weekly) may wish to track earlier metrics (PAR1, PAR7, or PAR15). Even for lenders with monthly schedules, PAR1 has its place as an early risk indicator if considered together with the trends in PAR30 and PAR90. One day in arrears (PAR1) does not constitute a default. But an increase in the number of customers falling under PAR1 can alert risk managers to investigate and address emerging problems that may preview further deterioration in the future.

It is common practice to analyze PAR statistics in segments: by origination period, branch, loan product, economic sector, responsible loan officer, etc. It is also important to analyze specific customer segments (e.g., male and female, on-grid and off-grid, farmers and traders). This can be helpful in detecting risk and default concentrations in certain parts of the portfolio. Segmentation can also help explain (to some extent) the underlying risk factors that are driving the arrears behavior. See Box 24 for practical nuance in analyzing individual clients.

BOX 24. **Problems with PAR, or how not all arrears are created equal**

Imagine a portfolio analyst for fictional company SolarCredit is looking at two borrowers on January 3: Aisha and Andrew. Both have missed a contractual payment of 100 KSH on January 1. Both are in arrears. But Aisha has made every payment for the eight months since originating her loan, although two payments were made 7 days late, while Andrew has missed his contractual payments in November and December as well (and so has not made a payment for 93 days, since October 1).

Aisha is currently delinquent on her loan, and would be counted in a PAR1 metric since her exposure is delinquent for more than 1 day. But SolarCredit should be reasonably confident (though not certain) that it can collect her arrears and will not yet consider her future payments to be at risk. However, SolarCredit should now consider it highly unlikely that Andrew will make another payment. His account is included in PAR90 (since his exposure lies in the loans that are delinquent for more than 90 days in arrears), his entire outstanding balance should, at minimum, be considered 'at risk' and should likely be processed through a stricter collection procedure. If his asset can be repossessed and resold, some or all of that balance may be recovered. Whatever is not must be written off as a credit loss.

Collection rate

PAYGo PERFORM defines 'Collection Rate' ('CR') as the "ratio of all collected receivables payments over total receivables payments due for a period (not including deposits)."[30] Put simply, Collection Rate tells us what percentage of a customer's expected payments were actually received in a given period, excluding the deposit. The complement of the Collection Rate (1-CR) is whatever was not received.

There are two main ways of tracking Collection Rate: Overall and Ongoing (terms vary from company to company). Overall Collection Rate shows, on a given date, the percentage of all expected payments that a borrower has made as of that date. Ongoing Collection Rate, on the

29 90 days overdue is a common industry standard for default, widely applied by regulators and supervisory organs. However, different industries may have different benchmarks for when a receivable is deemed non-performing.

30 The PAYGo PERFORM initiative is an open, transparent industry process that seeks to develop a reporting framework and set of key performance indicators for the PAYGo solar industry. It comprises investors (private and debt investors, local and international banks, and development finance institutions), PAYGo executives, and experts in energy and financial inclusion from around the world, and is led by Lighting Global, GOGLA, and CGAP.

BOX 25. **Calculating Collection Rate**

Aisha acquired a PAYGo SHS from fictional company SolarCredit on September 1. The SHS has a daily rate of $0.25. When she acquired the asset, she made one payment for $7.50, unlocking it for 30 days. However in October she made two payments, each for $3, on the 1st and the 15th.

On November 1, Aisha's Overall Collection Rate stands at 88.53 percent ($13.50 / $15.25).

Her Ongoing Collection Rate for the month of October was 77.42 percent ($6.00 / $7.75).

other hand, shows the Collection Rate for a given period, for example the last 30 days. A sample calculation of both is in Box 25.

As PAYGo providers do not have fixed repayment schedules, a borrower's Overall Collection Rate is one of the clearest indicators of their risk profile. Higher Collection Rates mean a steady source of cash and an on-time loan completion. Low Collection Rates mean the company may not recover its capital on schedule, may not be receiving enough cash to cover maintenance and servicing costs, and could be indicators of future defaults. Each company should have a clear idea of what its target Collection Rate is for borrowers at various stages in their repayment cycle.

Receivables at risk

As long as payment schedules are contractually fixed, PAR can be calculated the same for asset finance as for any other type of lending. However, as soon as payments become more flexible, as is the case with PAYGo approaches, it becomes difficult to define what an arrear is.

Observe the four payment patterns shown in Table 6 below, showing payment for 10-day periods over 100 days. In a traditional definition of PAR30 (that is, a client with arrears that were due more than 30 days in the past), every customer would be considered 'at risk' by day 51.

However, more flexible payment schedules allow exactly the sort of payment behavior demonstrated by Customers #1 and #4. The customer can skip a day when necessary, but resume paying as soon as possible. A customer who pays 7 or 9 days out of every 10 may not be considered 'at risk' at all. But one who pays as seldomly as #2 is surely unacceptable, even if he has made a recent payment.

This is the dilemma of evaluating PAYGo portfolio health: an analyst needs to measure both nonpayment *and* slow payment. For nonpayment, PAYGO PERFORM recommends a metric called Receivables at Risk–Consecutive Days Unpaid, or RAR(CDU), which only counts clients as 'at risk' if they have made no payments at all for a given amount of time. RARX(CDU)X captures the percentage of the outstanding portfolio held by those clients who have not made a payment for X consecutive days.

$$\text{RAR(CDU)} = \frac{\text{Outstanding Receivables } > \text{ X Consecutive Days Unpaid}}{\text{Outstanding Receivables}}$$

This metric accounts for the flexibility of PAYGo without overstating the risk situation by capturing every client who misses a payment, many of whom may not actually be 'risky.' If a PAYGo lender can only calculate and monitor one RAR metric, it should be this one. But RAR(CDU) does have its weaknesses. For example, it does not capture those clients who are making payments but at too-slow a pace. Look at the previous example. Client #2 would never be counted in a RAR(CDU)90 metric, but remains a poor client overall. He may eventually stop paying (slow payment is a strong predictor of eventual nonpayment), but even if he continues at this pace, he will not complete his obligation for years past the contractual end date.

A second RAR metric helps measure the risk of these infrequent but still-active payers. Called Receivables-at-Risk Collections Rate ('RAR(CR)'), the metric is calculated as follows:

$$\text{RAR(CR)} = \frac{\text{Outstanding Receivables by Overall Collection Rate} < [X]\%}{\text{Outstanding Receivables}}$$

RAR(CR) allows an AFC to identify receivables that are owed by clients who are paying frequently enough to avoid being counted in RAR(CDU), but infrequently enough to represent a potential risk. By combining this metric with RAR(CDU) (without double-counting) a company

TABLE 6. **Comparing portfolio at risk across multiple customer profiles**

	10	20	30	40	50	60	70	80	90	100	Collection Rate
Customer #1	$		$	$	$	$		$	$		70%
Customer #2	$							$			20%
Customer #3	$			$			$			$	40%
Customer #4	$		$	$	$	$	$	$	$	$	90%

can get a clear picture of how much of their portfolio is at risk—in other words, held by clients who have stopped paying or who pay very little.

The risks of 'at risk' indicators

New leases usually perform well: even the worst borrowers usually manage to pay a few installments before they stop. As a result, recently disbursed leases will almost always display lower default rates, and higher collection rates, than older generations of leases. But that does not mean that they are less risky.

One fundamental problem with PAR and RAR is that they are lagging indicators: they do not account for recent leases that have not been active for long enough to reach the default threshold. It is a law of credit physics that no lease that was disbursed two months ago can be in default now if the default definition requires a lease to be more than three months in arrears. This can lead the PAR and RAR metrics to seriously underestimate risk levels.[31]

If an organization is rapidly growing, there will always be more new loans than older loans in the portfolio, and overall PAR will appear better than it otherwise would. Conversely, if portfolio growth slows or turns negative, PAR will go up.[32] However, neither of these movements necessarily mean that the risk exposure of the company has changed. The next section provides detail on how to analyze a growing loan portfolio in the face of these limitations.

5.3 Portfolio Analysis

In this section, we focus on three important analytics (the computational analyses of data) that all lenders should be conducting on a regular basis to inform their risk management:

- Vintage Curves
- Transition Matrices
- Recovery Analyses

VINTAGE CURVES

Vintage curves (also known as cohort analysis) help address the lagging issue of PAR and RAR. Vintage curves show the cumulative default/write-off rate (the 'bad rate') as a function of time since creation of the receivable. There is no size bias in comparing defaults at certain age across multiple years of operation, because the bad rate is expressed as a percentage of the originally disbursed amounts. Each month of disbursements is then plotted on a separate curve, with the independent variable (x) being the months after disbursement and the y axis showing the cumulative "bad" rate.

The 'bad rate' may refer to the PAR/RAR definitions above, and vintage curves could be plotted for 30 days overdue, 90 days, etc. The "bad rate" could also be set as write-offs, in which case the analysis would just show losses. Or companies may choose to combine the two, in order to compare losses and likely losses over time. Because the bad rate is cumulative, we would generally

31 For a detailed discussion of the complexities in monitoring arrears, see Rosenberg (1999).

32 If you stopped new disbursements all together, you could have PAR converging to 100%, as the non-defaulted loans are paid-off and the remaining portfolio consists exclusively of loans in arrears.

expect the curves to go up or stay flat over time. But if PAR or RAR are included, there is a chance they may improve over time.

Regardless, it is important to make sure that the denominator always stays the same for each month, and this should be the amount disbursed/leased in that particular month. Figure 13 illustrates the idea, using a 'bad rate' that includes cumulative gross write-offs, PAR90, and voluntary repossessions.

The closer that curves are to the X-axis, the better the repayment situation. If newer curves show a steeper slope (i.e., the bad rate is climbing faster compared to previous months), it could signal a deterioration in portfolio quality. Conversely, a flattening of more recent curves could show improvement. A variation on the same analysis, and using the same data, is shown in Figure 14 below. The higher the bad rate, the darker red the shading appears.

Looking at the chart, we can clearly see that some change has occurred in June 2020: the write-offs for loans disbursed that month are noticeably lower than preceding months. Of course, we do not know why—the company may have cut its disbursements by half and only chosen the best potential clients, or they may have changed their underwriting criteria. Credit managers can use this type of analysis to monitor progress in new loan cohorts and even set targets, for example an expected cumulative write-off rate at 90 days of 3 percent or lower.

TRANSITION MATRICES

A transition matrix allows lenders to track evolutions in repayment status over time. Presented as a table displaying migrations from one category of arrears to another, transition matrices show how frequently one type of customer (e.g., 31–60 days late) deteriorates (becomes 61–90 days late) or improves (becomes Current). A transition matrix is useful in guiding and tracking the effectiveness of monitoring, collections and recovery activities. A transition matrix can be used to calculate the probability of default, which taken together with the LGD or recovery analysis, can be used to calculate the EL in a portfolio. The transition matrix is based on the premise that if borrowers miss an installment, it does not necessarily signify a future default, but it is an indication that their economic situation has deteriorated and that the risk of default and loss is growing.

A typical transition matrix, such as in Figure 15, is built around 30-day arrear 'bands' (Current, 1–30 days late,

FIGURE 13. **Example vintage curve of 'bad rate' over cohorts**

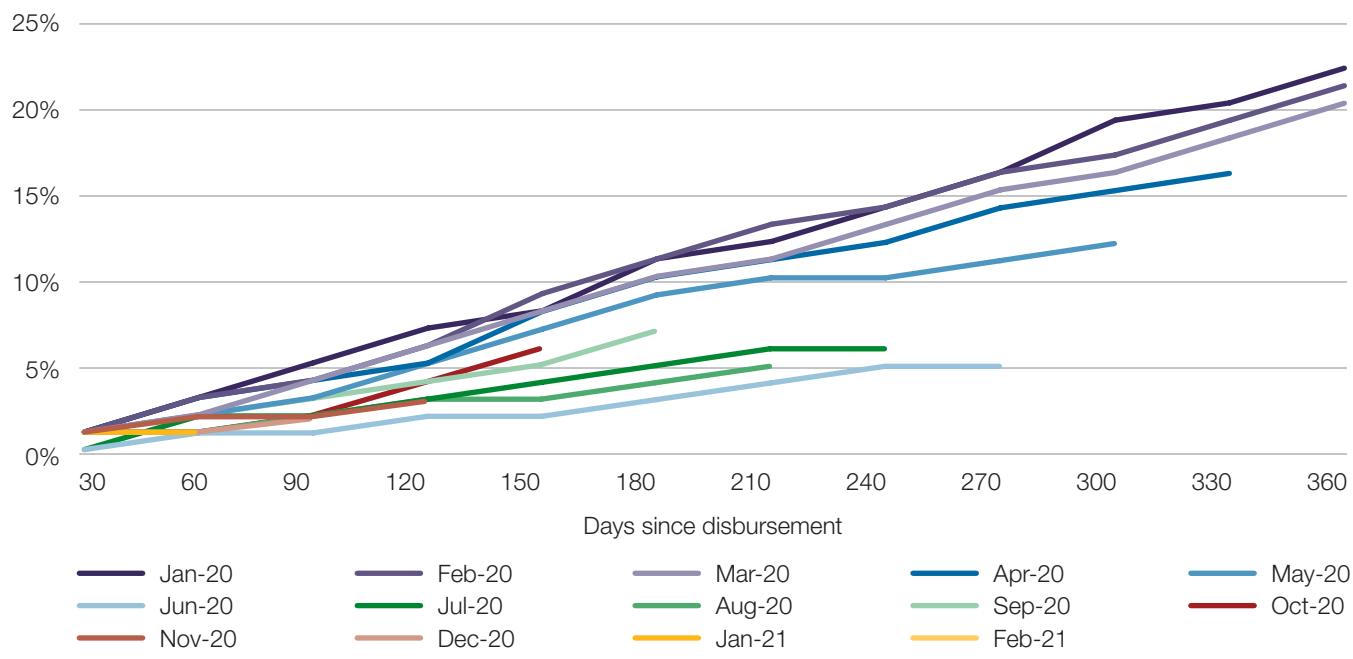


FIGURE 14. **Heat map vintage curve**

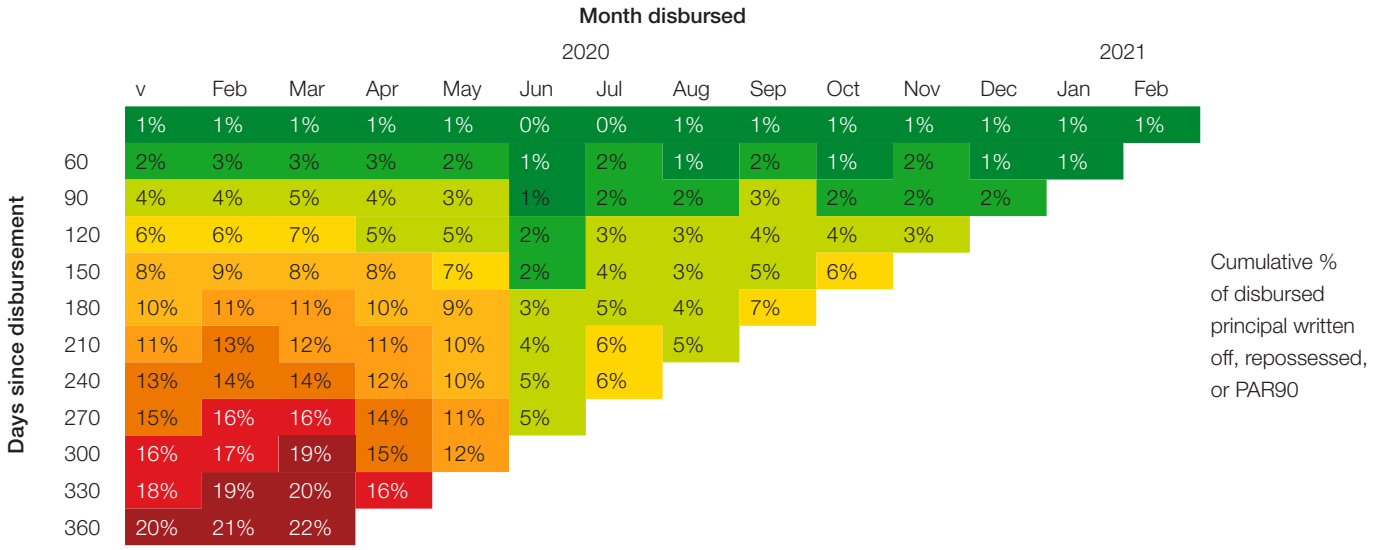


FIGURE 15. **Sample transition matrix with arrears bands**

12 months	Settled	Current	1–30	31–60	61–90	91–120	121–150	151–180	180+	w/o	1y PD
Settled	100.0%	-	-	-	-	-	-	-	-	-	-
Current	31.9%	56.1%	2.4%	1.2%	0.9%	0.8%	0.9%	0.7%	3.7%	1.3%	7.4%
1–30	34.6%	26.7%	1.2%	0.6%	0.5%	0.4%	0.5%	0.5%	24.4%	10.7%	36.6%
31–60	23.8%	7.1%	0.3%	0.2%	0.1%	0.1%	0.2%	0.3%	45.2%	22.6%	68.5%
61–90	8.8%	2.2%	0.1%	0.0%	0.0%	0.1%	0.1%	0.1%	56.5%	32.0%	88.8%
91–120	0.9%	0.6%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	59.5%	38.6%	98.4%
121–150	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	61.8%	37.7%	99.7%
151–180	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	64.4%	35.4%	100.0%
180+	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	65.1%	34.7%	100.0%
w/o	-	-	-	-	-	-	-	-	-	100.0%	-
	Current		Overdue			Default					

31–60, etc.). Clients are grouped first on the Y-axis by their past arrears status (December 31, 2019 in this example), then on the X-axis by subsequent arrears status (in this case, December 31, 2020).[33] Each row in the transition matrix represents the balance in a given arrears status as of December 31, 2019, ranging from current (no arrears) to just before the write-off point. The transition matrix then provides a view of how receivables act when they reach a certain stage of arrears—in other words, how many borrowers miss an additional payment, how many recover and become current again, and so on. Each row in Figure 15 represents an outstanding balance that was in a certain status as of 2019; the percentage figures along the row show what share of that balance are in which states in 2020. But transition matrices can also display currency figures or show the number and percent of borrowers in each transition.

Transition matrices are used not only to look backwards, but also to project forwards. Frequency leads to probability. Beyond just showing what happened in the transition during a particular period, an analyst can

33 As in PAR, the oldest arrears amount determines the classification of the entire principal balance. A client may have missed payments in each of the last 3 months, but all those arrears are captured in the 91–120 days bucket.

FIGURE 16. **Transition matrix with collection rate**

Transition Amounts (USD)

	7/1/2019	6/30/2020							
Collection Rate	Outstanding Amount (USD)	(1) <=30%	(2) 31%–50%	(3) 51%–70%	(4) 71%–90%	(5) 91%–100%	(6) >100%	Detached and Arrears >180 days	Estimated Unlocks
		59,526	72,576	89,541	96,282	65,936	1,122,822		
(1) <=30%	100,255	40,648	5,555	923	320		44	37,913	14,852
(2) 31%–50%	189,738	59,123	55,135	25,557	472			31,055	18,385
(3) 51%–70%	408,771	10,123	99,135	79,238	13,172		5	70,134	136,964
(4) 71%–90%	337,134	4,194	39,775	87,637	68,715	3,052		57,071	76,690
(5) 91%–100%	519,307	907	8,008	24,000	39,470	26,603	885	16,789	402,645
(6) >100%	1,269,300	11,197	29,100	59,323	70,433	51,616	82,435	14,926	950,269

Transition Rates (%)

	7/1/2019	6/30/2020							
Collection Rate	Outstanding Amount (USD)	(1) <=30%	(2) 31%–50%	(3) 51%–70%	(4) 71%–90%	(5) 91%–100%	(6) >100%	Detached and Arrears >180 days	Estimated Unlocks
(1) <=30%	100,255	41%	6%	1%	0%	0%	0%	38%	15%
(2) 31%–50%	189,738	31%	29%	13%	0%	0%	0%	16%	10%
(3) 51%–70%	408,771	2%	24%	19%	3%	0%	0%	17%	34%
(4) 71%–90%	337,134	1%	12%	26%	20%	1%	0%	17%	23%
(5) 91%–100%	519,307	0%	2%	5%	8%	5%	0%	3%	78%
(6) >100%	1,269,300	1%	2%	5%	6%	4%	6%	1%	75%

forecast on the assumption that next month's transition might be similar. This moves us from observed frequencies to anticipated probabilities.

Based on the example above, which was constructed on 12 months, there is, for instance, a 1.2 percent likelihood that an obligation which is Current in Period 1, will end up in the 31–60 days bucket in Period 2 a year later (box framed in blue in Figure 15). To calculate the probability of a current obligation going into default over a period of 12 months, it is also possible to add the probability for all columns starting from 91–120. For example, looking at an obligation that is currently 31–60 days in arrears, the probability of default would be 68.5 percent (boxes framed in orange). Building on the above example, transition matrices are useful for portfolio managers when seeking to predict the future.[34] Annex 6 shows how transition matrices can be multiplied with themselves to calculate the overall probability of default.[35]

In the case of flexible lease schedules the concept does not change, but the various 'buckets' may. One approach (shown in Figure 16) is to use Collection Rate. In this case, the row/column headings show customers who are >100%+, 91–100%, 71–90%, etc. The top table shows how the amounts outstanding in July 2019 have transitioned over a subsequent year, the bottom table shows the same transition, but expressed in percentage terms of the July 2019 outstanding balance.

If a company has a well-functioning scoring model in place, the same logic can be used with credit scores. However, this requires a regular re-calculation of scores. A final approach is to use internally defined client segments as the transition

34 As long as individual risk profiles do not change a lot over time. If either customer segments change (e.g., due to an adjusted business strategy) or a crisis occurs (e.g., a pandemic), the future may look less like the past.

35 With an increasing error margin, the longer this period becomes—in particular if there are seasonal default patterns, those should be included for at least one cycle.

buckets. For example, a company may have Good, Average, Risky, and Bad clients, where a Risky customer is one who has not made a payment for at least 30 days *and* has a collection rate between 30 and 70 percent.

RECOVERY ANALYSIS

Recoveries are money received after default, which may come from different sources (e.g., the client themself, guarantors, other finance providers, voluntary sale of assets, confiscation and realization of collateral/lease items, etc.) and most commonly are a result of collections actions. In asset finance, where the asset serves as ready collateral, recoveries are a major part of credit risk management.

The Recovery Ratio is often expressed as a percentage of the EaD, which is the outstanding principal at the moment of write-off. The complementary ratio expressed as (1 – Recovery Ratio) is then called the LGD. As mentioned above, it is crucial to apply a strict NPV approach when calculating the value of recoveries, as well as the cost of confiscation, re-sale and other costs (e.g., re-sale discounts). For a more thorough explanation of how to calculate NPV of recoveries, see Annex 3.

However, while these focus on the recovery of individual asset values, we also want to stress the forward-looking component with regard to portfolio management. Empirical recovery history can and should be used to predict future LGD, potentially broken down by distinct customer segments and/or loan products. It is also important to recognize that recoveries tend to be higher when there is collateral in place that can be resold or redeployed. As mentioned before, this is particularly true for lease contracts where the leasing company retains ownership of the asset and can therefore repossess it with less difficulty.

A typical portfolio LGD estimation approach would be weighting the historically observed individual LGD rates using their respective exposures at default and dividing them by the total exposure of default. A model of this is shown in Box 26.

BOX 26. **Fictional company SolarCredit's LGD**

For simplicity's sake, assume that Solar Sun has had only three contracts default in its history.

Receivable #	Outstanding at Default (KSH)	LGD rate (NPV based)
1	1,000	75%
2	400	60%
3	1,200	50%

$$\text{Weighted Portfolio LGD} = \frac{(1{,}000 \bullet 75\%) + (400 \bullet 60\%) + (1{,}200 \bullet 50\%)}{1{,}000 + 400 + 1{,}200}$$

$$= \mathbf{61.15\%}$$

5.4 Concentration and Diversification

Concentration risk in a portfolio refers to the risk inherent when risk-carrying assets (e.g., loans, leases) have a common exposure, for example when they are concentrated in a particular geography or economic sector. Imagine a portfolio that is completely concentrated in one city that is regularly hit by natural disasters, or has concentrated exposure to farmers of a rain-dependent crop. It would only take a fairly routine event (an earthquake or a drought) to result in catastrophic losses. By diversifying the geographies and sectors included in their portfolios, lenders can manage concentration risk, thereby avoiding unexpected and stress losses.

Concentration risk in credit covers several types of concentration, including name concentration, product concentration, geographic concentration, and sector concentration. Concentration analysis, along with diversification and defined limits on portfolio concentration, allow lenders to proactively identify and address these concentration risks, as explained below.

Name concentration

The outsized concentration of credit exposure with one or several borrowers, where a single default could

threaten the viability of the institution. This tends to be a less significant risk in asset finance, but larger leasing companies may still want to limit the percent of equity or assets that is tied up in a single exposure.

Product concentration

Offering multiple products is a good way to mitigate risks arising from technical failures or supply chains. It is possible that defects may emerge in a product over time, or that the supply of a product could be disrupted. By financing a range of products (ideally from a range of manufacturers), a lender can isolate any losses that result from technical failures while continuing to have a healthy, growing portfolio. This is also a place to manage the risk of obsolescence; a risk manager should be careful that a company's portfolio is not overly concentrated in older assets, as these customers may stop paying if a newer and/or cheaper model becomes available. Offering a range of diverse assets (e.g., smartphones and solar pumps) is also a way to avoid overexposure to one client segment or economic sector (see below).

Geographic concentration

Particularly for low-income customers, many risks such as droughts, floods or civil unrest are local. Early stage companies may have a limited number of customers, but ensuring that those customers are spread across different regions of one country can at least help to limit the damage of any one event. In the long-term, expanding into different countries (although that carries its own risks) can offer even more diversification.

Sector concentration

Closely linked to geographic and product concentration, lending to a single economic sector or occupation means that a downturn in that sector could create widespread defaults. Some AFCs focus on a single product or value chain, which is an obvious and presumably accepted risk. Other AFCs may finance multiple products for a single customer segment, such as people engaged in, or linked to, smallholder agriculture.

These concentrations may be acknowledged and accepted, but that does not remove the inherent risk. Wherever possible, companies ought to diversify their exposure. This could happen by adding other financed assets, expanding into new geographies or undertaking detailed research on existing customers to understand their vulnerability to various shocks.[36]

Concentration analysis

Companies need to regularly assess the concentration of their portfolio within the parameters described above (product, geography and sector). Concentration analysis is meant to be extremely forward-looking: what regions or segments is the company overly exposed to and would therefore cause particular harm if defaults spiked?

Basic concentration analysis can simply show the percentage of outstanding portfolio that is concentrated in various regions, products or sectors (see Table 7). More detailed analyses can be done using the Herfindahl-Hirschman or Gini indices, among others. Bandyopadhyay (2010) provides a good technical breakdown of the various measures of concentration risk, and their advantages and disadvantages.

DIVERSIFICATION AND LIMITS

The underlying idea behind diversification is always to reduce positive default correlations between individual exposures. The higher the positive correlations are, the higher the likelihood that the default of one exposure implies the default of the second.[37] An AFC should not be overly exposed to one region or branch, nor should any one region have an over-concentration in one customer segment.

To achieve this, companies can develop a limit framework like Table 7. This framework uses regions and sectors to divide the portfolio, with the 'Limit' column indicating the maximum share of overall exposure that *ought* to be in a given region-sector-combination, and the 'Actual' column showing current portfolio concentration.

36 There are a number of comparably easy-to-implement machine learning algorithms for clustering exercises. One of the most common ones is called "k-Means". The current pandemic may give valuable insights on the vulnerability of different customer profiles to such shock.

38 We do not necessarily refer to a causal connection. The mere fact that two customers live in the same region makes them both prone to the same natural disaster.

TABLE 7. **Concentration limits and actual distribution**

	Regional Total		MSME Assets		Durables		Agriculture		Transportation		Personal Electronics	
	Limit	Actual	Limit	Actual	Limit	Actual	Limit	Actual	Limit	Actual	Limit	Actual
Region 1	23%	32%	7%	9%	2%	4%	3%	3%	5%	6%	6%	10%
Region 2	22%	22%	10%	8%	2%	2%	0%	0%	5%	5%	5%	7%
Region 3	10%	12%	3%	3%	5%	6%	0%	0%	1%	2%	1%	1%
Region 4	19%	18%	4%	5%	2%	5%	6%	2%	3%	2%	4%	4%
Region 5	26%	16%	5%	3%	4%	3%	13%	5%	2%	1%	2%	4%
Sector Total	100%	100%	29%	28%	15%	20%	22%	10%	16%	16%	18%	26%

It is easy to see, looking at Region 1 or Personal Electronics in the above figure, how small over-concentrations at a branch or product level can leave a company dangerously over-exposed on aggregate. It is of crucial importance to establish who is responsible for observing and reporting on limit breaches, then to establish adequate measures once those breaches are detected in order to avoid significant overexposures. All of these roles and responsibilities can be outlined in policy documents and reinforced by risk managers.

5.5 Expected Loss and Unexpected Loss in Risk Management

CALCULATING AND USING EXPECTED LOSS

As mentioned at the top of this chapter, the EL on a given loan is the product of the probability of default (PD), the LGD and the EaD. The expected portfolio loss is the sum of all individual expected losses.

$$EL = PD \bullet LGD \bullet EaD$$

The PD is typically standardized to one year forward and can be taken from the transition matrix. The LGD comes from the recovery analysis. Both can be calculated on the total portfolio or distinct sub-portfolios (products, segments, geographies). In any case, the PD is essentially a function of the current arrears status;[38] EL on an individual exposure go up once the arrears status deteriorates. The EaD is the outstanding exposure at the moment of default, averaged across all relevant defaults.

As the term EL already implies, that is the amount a company can *expect* to lose on a given portfolio under ordinary (i.e., similar to the past) business conditions.[39] Therefore, that amount should always be priced in. If it is not, assuming the average EL is 10 percent for an average exposure, a company should increase the lease price accordingly (to do that, divide 1 by the expected return, which is just the inverse of the EL. So (1/.9) - 1 = 11.1 percent) to achieve the same expected return. The EL that is priced should depend on the type of product, whether it is new or used, what country it is financed in, etc. As EL increase or decrease, so should the interest rate.

Provisioning

Companies are expected to account for their EL in their books at the time the loan/lease is originated, as shown in Box 22 at the beginning of this chapter. The procedure of recognizing this amount as an expense is called *provisioning*. It is mandatory for regulated financial

38 As stated earlier, collection rate or internal credit scores can also be used.

39 Assuming a portfolio of 120 loans (with equal risk profiles) where on average every sixth loan defaults and further assuming the LGD to be 100% (hence no expected recoveries after default), that would be nothing else than rolling a die, where every [6] would show a default. Rolling the die 120 times (once for each loan) one would expect 20 defaults, with a standard deviation of (sqrt(120• (1/6)*(5/6)) = 4.1.

institutions, and the standard reference framework on provisions is called IFRS 9.[40]

However, even for unregulated lenders, it is best and recommended practice to implement accounting procedures for provisioning. It forces lenders to transparently report the quality of their portfolio and its EL, which in turn is an incentive for better assessment. Provisioning also makes it harder to gloss over poorly aging receivables with lots of shiny new loans.

UNEXPECTED LOSS AND STRESS TESTING

If the risk profile for many or all loans increases simultaneously due to unexpected developments, the EL formula calibrated on "the old parameters" may fail spectacularly. For example, assume a portfolio is concentrated in a particular area in Ghana that is hit by a drought destroying a significant part of all harvests in that region. In this case, the underlying assumptions from the PD estimation are no longer valid, and losses are likely to significantly exceed calculations of EL.

Stress testing

Stress testing is an appropriate and common approach that lenders use to plan for catastrophic events. These tests simulate unlikely, but nevertheless possible, scenarios that could have a devastating effect on portfolio quality and repayment rates. The coronavirus pandemic—ongoing as this Guide is being drafted—is one recent example. Other examples include:

1. Natural disasters of all kinds
2. Terrorist attacks/political unrest, etc.
3. Economic/financial crises

It is beyond the scope of this paper to suggest realistic stress scenarios, as they must be specific to each individual company and its context. However, a typical stress test might assume the following circumstances:

1. At minimum a significant delay in receiving contractual payments; a potentially serious increase (2x or higher) of PAR/RAR and defaults. For PAYGo companies, a 25 percent reduction in Collection Rate.
2. Massive requests for restructuring, moratoria, etc.
3. Limited opportunities to generate (healthy) new business, i.e., a rapid slowdown in growth rate.
4. Liquidity problems for financial institutions as a result of the above.

An institution should regularly undergo internal stress tests to highlight vulnerable areas, especially effects on capital and liquidity, with an emphasis on short-term liquidity. Realistic scenario assumptions could be informed by studying the effects of recent crises, (e.g., the East African locust swarms of 2020). The tests are usually built using portfolio quality shifts that are multiple standard deviations from a base scenario and macroeconomic developments (such as FX rate shifts) that are in the 99th percentile (i.e., severe and unlikely).

Each institution should define criteria under which a stress test is considered passed, for example maintaining a capital ratio of at least X percent, having Y percent of assets be highly liquid at all times, etc. If an institution fails a test, mitigating measures (boosting liquid asset levels, reducing leverage) need to be taken by management *before* the onset of a crisis event.

Mitigating unexpected loss

A particular scenario for AFCs to focus on is abrupt technological obsolescence (e.g., if a competitor issues a higher-quality, cheaper replacement). This could lead to a wave of clients ceasing payment and/or returning their equipment, while at the same time leading to higher LGD as the outdated equipment will be difficult to redeploy profitably (see Box 27).

One key measure can help mitigate vulnerability to such events: keeping maturities short. A natural maximum maturity is the useful life of the asset, but keeping the lease term lower will lead to more sustainable businesses. Of course, responsible lending to the poor requires

40 The basic framework is relatively simple for standard loan and lease products. It distinguishes between three stages, which loans are classified as depending on their current arrears status. For a stage 1 loan, a 12-month PD shall be used to calculate EL. For Stage 2 loans, this turn into a life-time probability: if the remaining contractual life is two years, then multiplying the 12-months transition matrix with itself gives the PD estimate for 24 months. Stage 3 would be considered as defaulted, hence the assumed PD would always be 100 percent. See BIS (n.d.) for more.

BOX 27. **Correlated losses for SolarCredit**

Assume a competitor has entered fictional company SolarCredit's SHS market with a cheaper, more powerful system. Within several weeks, SolarCredit customers begin to stop payment and switch to the new system. SolarCredit is able to recover many of the defaulted systems, but the value of these is close to zero, given the improved technology on the market.

These correlated spikes in PD and LGD are not uncommon in asset finance. In the US subprime crisis, a spike in defaults resulted in numerous forced home sales, which led to a significant decrease in housing prices. LGD rates were therefore much higher than provisioned (Zhang et al., 2010).

longer-than-average maturities so as to not overburden customers with high installments. However, the risk of technological change, combined with increasing defaults and higher cost of funds, may endanger the business model of lenders with overly long tenors.

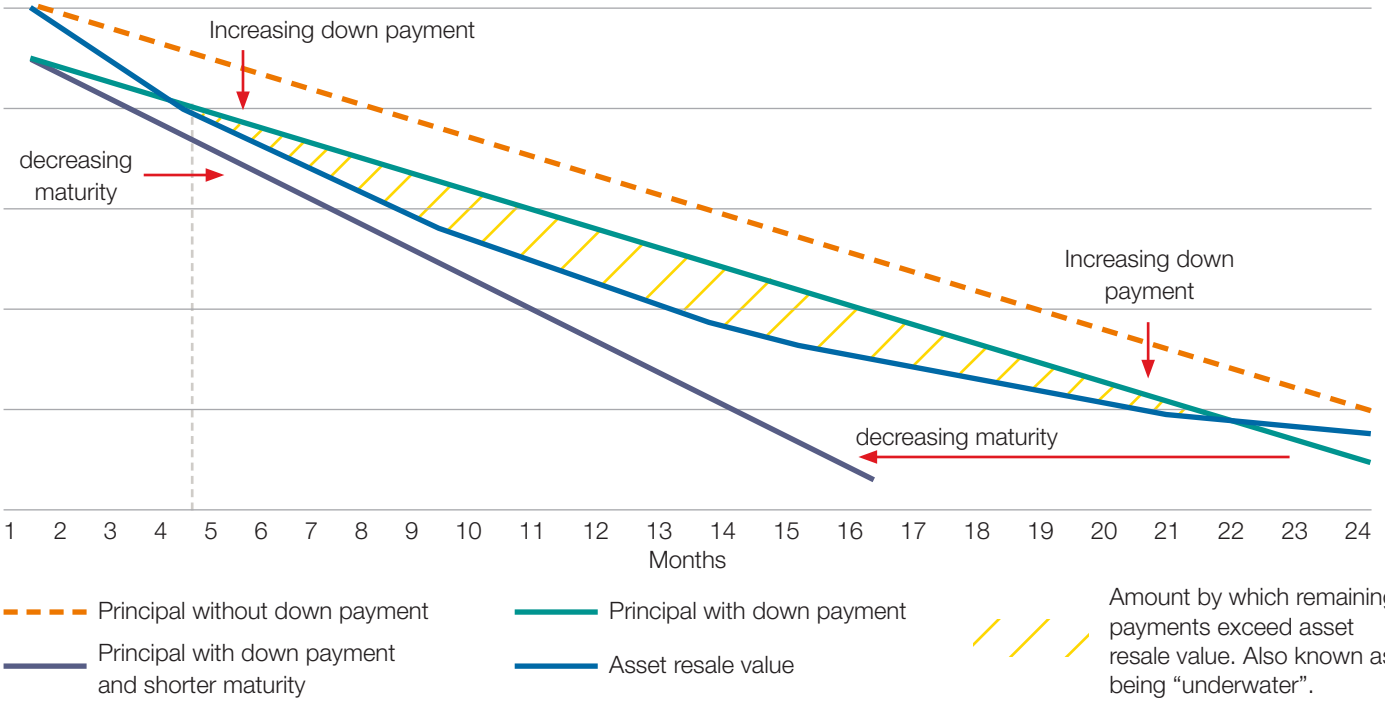
Figure 17 shows the decline in an asset's value relative to a customer's repayment. A company should try to always keep the resale value (blue line) higher than the outstanding principal (various orange lines). This can be achieved with higher down payments and shorter maturities. In this example, even increasing the down payment would not be enough to always keep the outstanding principal below the resale value (the shaded area between 4 and 21 months). But reducing maturity (i.e., increasing monthly payments) along with increasing the down payment accomplishes this goal (dark-brown line).

Most of the defaults in asset financing happen relatively soon after disbursement, with a leveling off followed by a slow decline as clients default for various reasons. The longer the average tenor, the longer each loan is exposed to a potential credit event, whether individual or widespread.

5.6 Monitoring and Dashboards

Finally, all of the various analyses and indices described in this chapter must be tracked, stored, and monitored. This should happen on a daily basis for key risk staff, but should also be presented and discussed by the company's senior management on a more periodic basis (weekly or monthly).

FIGURE 17. **Looking at depreciation curves with different loan tenors and down payments**



KEY RISK INDICATORS

Beyond PAR, RAR, and Collection Rates, we encourage institutions to use a wide set of KRIs to analyze portfolio performance from different angles and to serve as early-warning system for negative developments. KRIs are a set of indicators that condense portfolio quality data into easily obtained numbers, which can then be tracked over time.

Indicator calculation should require a minimum of human input; ideally all the work is done automatically in the system. Indicators should be linked to warning and alert thresholds, which are in turn linked to action triggers. The diversification matrix shown above (Table 7) can be understood as an example of a KRI with a set of warnings and triggers. A recommended action in case of limit breach could be a disbursement slowdown in the respective area, or at least a stronger sales focus on the remaining areas.

KRIs should be calculated and easily accessible from a centralized viewing platform, or *credit dashboard. The dashboard s*hould be built to enable regular management reporting, (preferably in real-time web-based dashboards) as well as ad hoc reviews in case of limit breaches.

Sample credit KRIs could include:

- PAR 1, 30, 90, including vintage curves
- RAR at various 'risk levels' (e.g., 30 percent, 50 percent and 70 percent)[41]
- Write-off Rate
- Restructuring Rate including 'cure rate' (migration from 'at risk' to 'good' status)
- Transition Matrix (both month-on-month and year-on-year)
- EL development/provisioning
- Repossession/Recovery Rate (in NPV)
- Disbursement growth/decline
- Diversification indicators
- Early Defaults (segmented by agent or loan officer)

For all lenders, but particularly for AFCs, credit KRIs cannot exclude operational risk. The following list provides several examples:

- Number of service tickets originated (tracked by week and month)
- Average time to resolve service ticket (by week and month, as well as MoM change)
- Number of fraud incidents and value lost to fraud for previous week/month
- Number of repossession tickets originated
- Average time to repossess unit (from ticket origination)
- Average time to refurbish and redeploy a repossessed unit
- Number of inbound customer calls received
- Percentage of outbound customer calls answered

The list is certainly not complete. It is also important to highlight that the company should be able to slice or filter these indicators across a number of parameters, e.g., per branch, agent, and then product. With that, managers should be able to zoom into an indicator to identify where problems occur and stem from.

41 PAYGO PERFORM recommends tracking RAR(CDU)>30 days and RAR(CR)<50%

CONCLUSION

Achieving sustainability in the asset finance sector will require long-term investment in risk management structures that underpin scale.

In an assessment of the systemic issues created in microfinance by a period of unprecedented growth, Chen et al. (2010) wrote: "In the next decade, the focus should be on sustainable growth…The recent delinquency crises are a reminder that microfinance remains a risk management business." Their comments proved prophetic: over the next three years, the microfinance industry performed a deep self-assessment resulting in a renewed focus on risk management, increased adoption of consumer protection principles such as the SMART Campaign and the publication of the Universal Standards of Social Performance Management.

Evidence from the 'Microfinance Barometer 2019' shows what 'sustainable growth' can look like: the number of microfinance borrowers grew by seven percent year-on-year from 2012 to 2019, compared to almost 20 percent annual growth in the previous decade, while loan portfolios grew at a solid 11 percent annual average. For all that, concerns of overheating and overindebtedness still crop up, and likely always will, because lending is a risky business.

Operational expense ratios fell while return on assets increased, although there are valid concerns that this may have come by moving away from lending to the poorest households. In short, the microfinance sector may be past its hype cycle and far from perfect, but it is doing important work at scale: 140 million people borrowed $124 billion from MFIs in 2018.

This is what the future can hold for asset finance—that is, if practitioners and investors can learn from the past. Widespread scale and impact are possible for credit-based business models, but there are no shortcuts: growth in asset finance needs to be accompanied by an increased investment in risk management. This means establishing the culture, strategy, appetite, and limits that enable good risk management, while at the same time investing in people: the analysts, auditors, compliance monitors, and risk managers who can ensure that an organization grows at a pace that is commensurate with its appetite.

Poor households around the world need responsible consumer asset financing, and meeting that need means taking risks. Managing those risks will be the difference between failure and success in asset finance.

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ANNEX 1

SAMPLE RISK APPETITE: STATEMENT FROM BHARAT FINANCIAL INCLUSION

The following is taken from "Annual Report of Bharat Financial Inclusion Limited (Formerly known as 'SKS Microfinance Limited' for FY 2016-17" pages 39-42.[42]

IV. RISKS AND MANAGEMENT STRATEGIES

Risk is an integral part of the Company's business, and sound risk management is critical to the success of the organisation. As a financial intermediary, the Company is exposed to risks that are particular to its lending and the environment within which it operates. The Company has identified and implemented comprehensive policies and procedures to assess, monitor and manage risk throughout the Company. The risk management process is continuously improved and adapted to the changing risk scenario and the agility of the risk management process is monitored and reviewed for its appropriateness in the changing risk landscape. The process of continuous evaluation of risks includes taking stock of the risk landscape on an event-driven basis.

The Company has an elaborate process for risk management. This rests on the three pillars of Business Risk Assessment, Operational Controls Assessment and Policy Compliance Processes. Major risks identified by the businesses and functions are systematically addressed through mitigating actions on a continuing basis. These are discussed with both the Management and the RMC. Some of the risks relate to competitive intensity and the changing legal and regulatory environment. The RMC of the Board reviews the risk management policies, in relation to various risks and regulatory compliance issues.

The Company identifies the following as key risks:

POLITICAL RISK

The Company recognises political risk as one of the major risks facing the industry and believes that political risk can be mitigated through responsible lending and fair pricing by way of:

- **Lowest cost lender –** The Company charges the lowest interest rates among NBFC-MFIs to its Borrowers.
- **Voluntary Cap on RoA from core lending –** The Company has voluntarily capped its returns from core lending at 3 percent.
- **Robust Customer grievance redressal (CGR)** Mechanism with Independent Ombudsman.
- **Calibrated Growth –** The Company's growth strategy aims to meet the requirements of its Members and also address concerns of various stakeholders.

42 See https://www.bseindia.com/bseplus/AnnualReport/533228/5332280317.pdf

CONCENTRATION RISK

The Company aims to avoid unbalanced concentration in both its loan portfolio and borrowings. To mitigate the concentration risk, the Company has a well-defined geographic and borrower dependence norms.

Geographic concentration norms: In order to mitigate the risk of external intervention, concentration in any particular state, district or branch, as well as to manage non-payment risk, the Company has implemented the following limits:

(A) Disbursement Related Caps: The disbursement limits stipulate each state to entail less than 15% of the total disbursements for the Company (except states of Karnataka and Odisha which have a 20% limit); each district to entail less than 3% of the total disbursements for the Company (except districts in states of Karnataka and Odisha which have a 4% limit); each branch to entail less than 1% of the total disbursements for the Company (except branches in states of Karnataka and Odisha which have a 1.25% limit); no disbursements to be made by branches that have an NPA of more than 1% or collection efficiency of less than 95%.

(B) Portfolio Outstanding Related Caps:
– Gross Loan Portfolio: Each state to ensure that its Gross Loan Portfolio will not exceed 75% of the Company's net worth (except states of Karnataka, Odisha and Maharashtra which have a 100% limit); each district to maintain that its Gross Loan Portfolio will not exceed 5% of the Company's net worth (up to 5% of the operating districts may go up to 10% of the Company's net worth); each Branch to maintain that its Gross Loan Portfolio will not exceed 1% of the Company's net worth (up to 5% of the operating branches may go up to 2% of the Company's net worth).

– Loan Portfolio Outstanding: Each state to ensure that its Gross Loan Portfolio will not exceed 15% of the Company's total portfolio (except states of Karnataka and Odisha which have a 20% limit). The caps are subject to tolerance of 10%.

Borrowing dependence norms: In order to reduce dependence on a single Borrower, the Company has adopted a cap on borrowing from any single credit granter at 15%. The share of borrowing from top 3 banks reduced significantly from 61% in March 2013 to 24% in March 2017.

OPERATIONAL RISK

The core business of the Company is to provide collateral free loans in rural areas, and consequently, requires enhanced operational risk management. To mitigate the operational risk, the Company adopts the following strategy.

Integrated cash management system:

- The Company's transactions with borrowers are predominantly in cash, making cash management an important element of the business. To reduce the potential risks of theft, fraud and mismanagement, the Company has been implementing an integrated cash management system since July 2009 which is operational in approximately 1,328 of its branches, as on March 31, 2017. The system utilises an Internet banking software platform that interfaces with various banks to provide the Company with real-time cash information for these branches and the loan activity therein.
- The Company believes this integrated system augments its MISs and facilitates its bank reconciliations, audits and cash flow management. The system also reduces errors.
    - **Product and process Design –** The Company adopts a standardised approach to product design and operational procedures at the branches and centers to enable predictability of transactions, as a risk mitigant.
    - **ISO Certified Internal audit –** The Company has adequate controls and processes in place with respect to its operations. The Internal Audit department acts as the third line of defence by monitoring adherence to controls and processes and provides inputs for strengthening risk management. The Internal Audit function has been certified with ISO 9001:2008.

LIQUIDITY RISK

The Company places significant importance on liquidity management and has a bias for liquidity, mainly to address the operational requirements and corporate commitments. Along with funding strategy and asset liability management, the Company has well defined liquidity metrics, including cash burn, optimal liquidity and liquidity cap test, to ensure sufficient liquidity in line with business requirements and aid risk mitigation.

V. INTERNAL CONTROL SYSTEMS AND THEIR ADEQUACY

The Company has a well-established and strong internal controls with well-designed systems, policies and procedures to maintain financial discipline. The Company's Internal Control Systems are commensurate with the nature of its business and the size and complexity of its operations. Based on the guidelines received on various issues of control from the Reserve Bank of India and the Government of India, the Company's Board of Directors and the Audit Committee of the Board are a part of the Internal Control System for better compliance at all levels.

The Internal Audit Department of the Company is an independent function which ensures, checks and evaluates operational risks, internal controls, internal financial controls, adherence of systems, policies and procedures by conducting inspection of branches/ offices. These are routinely tested and cover all Branches, Regional Offices and the Head Office. Significant audit observations and follow-up actions, thereon, are reported to the Audit Committee. The Audit Committee of the Board oversees the Internal Audit function of the Company.

The Audit Committee reviews the adequacy and effectiveness of the Company's Internal Control System, including Internal Financial Controls and monitors the implementation of audit recommendations, including those related to strengthening of the Company's risk management policies and systems. The Audit Committee monitors compliance with inspection and audit reports of the Reserve Bank of India, other regulators and statutory auditors.

ANNEX 2

CREDIT RISK POLICY OUTLINE

Preamble	• This policy is part of the institution' Risk Management Framework. It has been approved by the Board of Directors. • Credit risk is naturally the dominant risk dimension for the institution, due to … (e.g., refer to risk exposure, probability of occurrence and potential impact compared to other risks incurred). • The institution engages credit risk deliberately and with the proper controls.
Target Markets	• Description of institution's vision and mission • Allowable clients, markets, products that the institution generally seeks to interact with and that may carry credit risk • Overall lending philosophy and credit risk appetite
Social Performance	• Desired economic and social development impact of lending operations • High-level impact measurement framework, indicators and achievement targets • Commitment to responsible finance and client protection principles
Lease Products	• Define credit product term sheets: · Eligible clients, · Eligible industries, · Amounts, rates, and fees, · Documentation requirements
Credit Assessment	• Evaluation and analysis of loan application • Statistical measures: statistical scoring, internal rating, expert scores, bureau scores, external rating, etc., for which clients and products at what intervals
Credit Approval	• Define approval process by product · Delegated authorities · Approval limits · Verifications and operational risk controls
Credit Monitoring	• For various client and product groups, define: · Monitoring methods · Responsible parties · Specified monitoring intervals
Portfolio Management	• Size concentration measures and limits • Industry and geographic diversification • Expected Loss (EL)/Unexpected Loss (UL) calculation • Stress-testing • Portfolio risk monitoring and controlling • Early identification of negative developments, adverse trends

Arrears Management	• Arrears management organization
	• Arrears analytics
	• Responsible collections practices
	  · Efficient collections actions
	  · Remote switch-off
	  · Repossession
	  · Restructuring and work-out of lease contracts
	• Provisioning

Measuring Performance	KRIs at a company level to be set, targeted on a quarterly or monthly basis, monitored by the CRO, and reported to Executives and Board

ANNEX 3

CALCULATING EFFECTIVE INTEREST RATES

Typically, companies offer cash sales as well as lease sales in parallel. Lease sale is typically more expensive when purely summing up the installments and the down payment. However, so far none of the assessed companies has implemented a consistent risk accounting or pricing approach for this. In MS Excel, effective interest rates are calculated as follows:

NominalMonthlyInterestRate:

= RATE (LeaseTermInMonths,MonthlyContractualInstallment, – CashPrice + InitialDeposit,0)
= IRR (ArrayOfMonthlyPayments)

EffectiveInterestRate p.a.:

= (1 + NominalMonthlyInterestRate) ^ 12-1

Assume a product with the following features:

- CashPrice = 10,000
- DownPayment | InitialDeposit = 2,500
- Term = 12 months
- MonthlyContractualInstallment = 750

The cashflows from a customer's point of view are as follows (in thousand):

M_0	M_1	M_2	M_3	M_4	M_5	M_6	M_7	M_8	M_9	M_{10}	M_{11}	M_{12}	Sum
7.5	-.75	-.75	-.75	-.75	-.75	-.75	-.75	-.75	-.75	-.75	-.75	-.75	-1.5

Note that the M_0 cashflow is +10,000 – 2,500 = 7,500. Of course, the positive number in reality is not a real cashflow, as the customer receives the asset, instead.

= IRR (M0:M12) returns 2.9% >> nominal monthly interest rate.

= RATE (12,750,-10000+2500,0) also returns 2.9%.

= [1+RATE (12,750,-10000+2500,0)] ^12-1 returns 41.3% >> effective yearly interest rate.

Check:

Real lease cashflows from a customer's point of view:

M_0	M_1	M_2	M_3	M_4	M_5	M_6	M_7	M_8	M_9	M_{10}	M_{11}	M_{12}	Sum
-2.5	-.75	-.75	-.75	-.75	-.75	-.75	-.75	-.75	-.75	-.75	-.75	-.75	-11.5

Customer cashflows discounted with the calculated effective yearly interest rate (41.3%):

M_0	M_1	M_2	M_3	M_4	M_5	M_6	M_7	M_8	M_9	M_{10}	M_{11}	M_{12}	Sum
-2.5	-.729	-.708	-.688	-.668	-.649	-.631	-.613	-.596	-.579	-.562	-.546	-.531	-10.0

Formula for M4: MonthlyContractualInstallment / $(1+ieff)^{(month/12)}$ = 750 / $(1+41.3\%)^{(4/12)}$ = -.688

Summing up the real lease cashflows discounted by the effective interest rate gives the cash price of 10,000.

ANNEX 4

DATA DICTIONARY

We propose to think about a data dictionary, which may start as a compilation and grouping of all potentially interesting data elements, and their features, such as

- Element name
- Element description
- *Element type* (date, integer, free string, dropdown, [Y/N], etc.)
- *Element Purpose* (primary and secondary – e.g., KYC requirements, customer default prediction, etc.)
- *Entity/Property of* (e.g., client, address, home, etc.)
- Gathering/calculation logic
- Verification logic
- *Data owner* (e.g., sales agents, risk manager, etc.)
- *Data recording and update* (when collected, how often, etc.)
- *Meta data recorded* (e.g., time stamps, time needed to complete surveys, etc.)

This dictionary should not be developed exclusively by the Risk Department, but understood as a joint exercise between all operational units. The ultimate goal of such task is to establish an advanced and to the extent possible complete and correct database to serve multipurpose analytical tasks, such as credit risk assessment, estimating marketing potential, fraud detection, measurement of recovery success, etc.

ANNEX 5

NPV REPOSSESSIONS

Assume a company has two customers A and B, both interested into leasing appliance X. X has to be imported from China, which creates costs for the good itself (purchase price) as well as expenses for transportation, customs, storage, etc. (altogether "costs of goods sold" – COGS). Such appliance then is sold (on lease) to customer A for a price of P, which is defined as COGS * (1 + GM) with GM being the gross margin (incl. lease interest). Assume A defaults and X_A is repossessed from her. Instead of selling a new appliance (also to be imported from China, etc.), the just repossessed item XA is sold to customer B (potentially with a discount, as this is not a brand-new item anymore).

What is important to understand is that customer B was not "created" because of A's default – instead B would have received X in any case. What the company saves in this special case is just the COGS, which accordingly must be the base value for the recovery calculation; hence (1 + GM) shall not be considered as recovery, as this part would have been "earned" independently from A's default.

The expected recovery calculation may look then as follows:

$$NPV_{Repo} = \frac{UnitCost \bullet RedeplRate - RefurbCosts - ContrBNValue \bullet RedeplRate \bullet ResaleDisc}{1 + \left(\frac{effInterest}{12}\right)^{\frac{RepoDate - DefaultDate}{30} + StorageTime}}$$

with

- *UnitCost* = COS incl. shipping, customs, etc.
- *RedeplRate* = Redeployment rate, hence the probability that the item will be sold again
- *RefurbCosts* = Refurbishment costs, hence the (estimated) costs to bring the item back to a saleable condition
- *ContrBNValue* = Contractual buy-now value, hence the cash price of a brand-new item of the same kind
- *ResaleDisc* = Resale discount, hence the (estimated) percentaged sale discount of the repossessed item in comparison to a brand-new item of the same kind
- *effInterest* = Effective annual interest rate of the lease contract
- *RepoDate* = Repossession date
- *DefaultDate* = Default date
- *StorageTime* = Storage time, the time between repossession and re-sale in days

The redeployment rate may differ from item to item and is certainly a function of the general condition of the item, the age and particularly the offered resale discount. As confirmed by multiple SHS providers, the redeployment rate often decreases for items that have been repossessed from another customer before (hence on which two different customers defaulted already). A proper recovery logic should incorporate that decline.

ANNEX 6

MULTIPLYING TRANSITION MATRICES

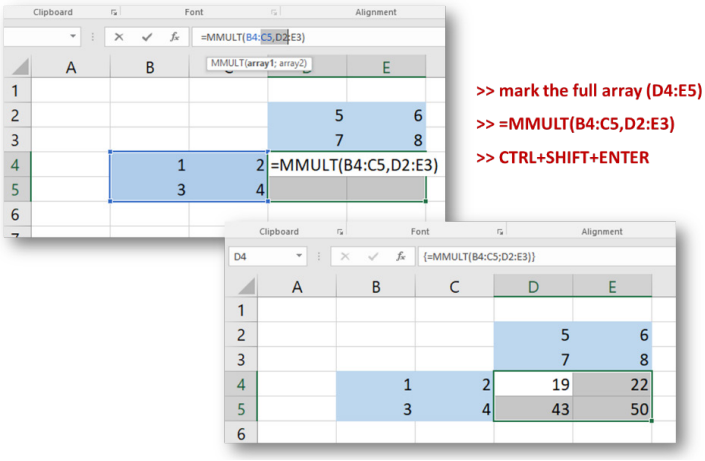
Multiplying a matrix built on i months with one built on j months would result in a matrix of i+j months. Assume, one only has a one-month matrix (established empirically), multiplying this with itself gives a two months forecast. That one multiplying with itself results in a four months matrix, which can easily used to calculate eight months, etc.

The following illustrations exemplify the mathematical principle of matrix multiplication – on paper as well as in MS Excel with the =MMULT() array function:[43]

$$\begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \rightarrow \begin{pmatrix} 19 & 22 \\ 43 & 50 \end{pmatrix}$$

$$\begin{pmatrix} 1 \bullet 5 + 2 \bullet 7 & 1 \bullet 6 + 2 \bullet 8 \\ 3 \bullet 5 + 4 \bullet 7 & 3 \bullet 6 + 4 \bullet 8 \end{pmatrix}$$



It may make sense to apply that logic for different customer segments, regions or other features, should there be significant deviations in the results.

43 Note, that matrices can only be multiplied if the number of columns of the first one equals the number of rows of the second one. Therefore, make sure that your input transition matrix has an equal number of rows and columns. The typically means to manually include one line for "Settled" and one for "Write offs", which both contain one value 100% and all others zero (compare the transition matrix example above – lines "Settled" and "w/o").