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Regtech at HSBC

Compliance has become a competitive factor in the banking industry. We need to find new ways to ensure safe operations in an efficient way. The old ways of trying to put more people on the problem are no longer viable.

— Mark Cooke, Global Head of Operational Risk at HSBC.

In July 2019, Mark Cooke, Global Head of Operational Risk at HSBC, one of the world's largest banks, needed to decide whether to roll out a new regulatory technology (regtech) solution to gain greater insight into the effectiveness of the three lines of defense (3LoD) model that the bank used to manage operational risk. Regtech was an emerging technology that used big data, machine learning, and artificial intelligence (AI) and came with the promise to help companies reduce risk and meet their regulatory requirements. Controlling operational risks—non-financial risks such as financial crimes, reputation, and regulatory compliance—had become increasingly important in the banking industry since the 2008 global financial crisis, resulting in the enactment of stricter financial market regulations, advancements in technology, and more complex business activities.

Cooke's decision came on top of HSBC's recent transformation of its 3LoD model. 3LoD was an industry standard approach to risk management that defined the risk management roles and responsibilities for each employee at the bank. HSBC undertook the 3LoD transformation in the wake of several risk events involving money laundering and other illegal activities that had emerged at the bank since the early 2000s. Since the financial crisis, HSBC had invested in excess of $1 billion per year in 3LoD and other regulatory compliance initiatives. HSBC's board of directors had begun to ask whether these 3LoD investments had produced the desired return on investment, and if so, what evidence did Cooke have to back that up. Cooke was not yet sure how to respond.

Over the previous two years, Cooke had been working with a regtech startup company that claimed it could monitor HSBC's email traffic and predict areas of risk within the bank before a crisis struck. The regtech company had recently completed a pilot of its product that had produced interesting results in one unit at HSBC. Cooke believed that the technology had potential, that it could help understand HSBC's existing 3LoD model effectiveness, and provide a new way to manage risks. However, implementing a regtech solution would be a fundamental departure from the traditional methods HSBC had relied on over the past decade to establish effective risk management behaviors, such as governance systems, employee training programs, staff surveys, town hall meetings, and other

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systems. Cooke wondered how much he could trust a technology from a startup company with a handful of employees and almost no revenue to meet the needs of a world-leading bank with global operations. He also wondered how he might convince HSBC, a historically conservative organization facing competitive pressures and looking to cut costs wherever possible, to go down this new path. Would the bank be willing to increase its analysis on its employees' communications? How would employees react? Should he ask the board to roll this out across HSBC, fund another pilot, or perhaps abandon the project in favor of sticking with the more traditional approaches to risk management?

HSBC

Founded in 1865 as the Hongkong and Shanghai Banking Corporation Limited, with a mission to finance international trade, HSBC soon had branches across Asia and Europe. Over more than a century, it grew through acquisitions and product diversification. In 1991, it became known as HSBC Holdings and following a major acquisition in 1992, HSBC moved its headquarters to London.[1] Historically, HSBC had operated primarily in the U.K. and Asia. In the late 1990s, however, the bank began marketing itself as "the world's local bank" and it undertook a series of mergers that brought it into new markets and led its customer base to grow from approximately 25 million in 1998 to 110 million by 2003.[2]

By 2019, HSBC was the world's seventh largest bank[3] with assets of $2.6 trillion.[4] HSBC had over 235,000 full-time-equivalent employees—55% in Asia and 25% in Europe—working in 70 countries throughout the world.[5] (See **Exhibit 1** for world's largest banks and **Exhibits 2** and **3** for HSBC financial statements.) HSBC had four global businesses consisting of Retail Banking and Wealth Management; Commercial Banking, Global Banking and Markets; and Global Private Banking, which were operating throughout the world. (See **Exhibits 4** and **5** for HSBC segment data.)

Legal and Regulatory Challenges

In the early 2000s, regulators uncovered a number of serious banking improprieties at HSBC. These included HSBC's involvement in the Bernie Madoff fraud scandal in the U.S.,[6] assisting wealthy clients illegally evading taxes through its Swiss unit,[7] money laundering the proceeds of drug traffickers in Mexico, and serving customers in Iran, Libya, Cuba, and other countries under sanctions.[8]

These improprieties led to regulatory action against HSBC, particularly in the U.S. In 2010, the Comptroller of the Currency, part of the U.S. Department of the Treasury, called HSBC's compliance program "ineffective" in reference to suspicious transactions earlier in the decade.[9] The regulator issued a cease-and-desist order—"the toughest action U.S. regulators can take against a bank"—which required "HSBC to submit a written plan of how it will improve compliance."[10]

Following the 2008 financial crisis and the emergence of its regulatory challenges, HSBC took steps to better control its operational risks and to de-risk its business. In 2009 to 2011 alone, HSBC invested heavily in its compliance function, increasing its anti-money-laundering expenditures nine-fold.[11] HSBC also took steps to simplify its business by reducing the number of countries in which it operated, eliminating certain customer segments, and increasing the level of centralized control over its operations. Furthermore, HSBC began taking steps to address cultural issues, which had attracted the attention of regulators. In mid-2012, one U.S. Senator referred to HSBC's culture as "pervasively polluted for a long time."[12] By 2015, HSBC had approximately 24,000 people, 10% of its staff, in "risk and compliance roles."[13] (See **Exhibit 6** for a simplified description of risks and controls.)

Deferred Prosecution Agreement In December 2012, U.S. regulators and HSBC reached a five-year deferred prosecution agreement (DPA) relating to money laundering and dealing with customers in sanctioned countries. The regulators filed charges against HSBC in court in 2012 that would be dropped in 2017 if HSBC met its obligations under the DPA. The agreement required HSBC to pay $1.9 billion in forfeitures and civil penalties. In the DPA, HSBC admitted that "it failed to maintain an effective program against money laundering and failed to conduct basic due diligence on some of its account holders."[14] The agreement also required HSBC to appoint an independent compliance Monitor to a five-year term to evaluate "the effectiveness of the internal controls, policies and procedures of HSBC" as they related to U.S. regulations.[15] This Monitor would issue periodic reports to the court. Under the DPA, HSBC was required to revamp its anti-money laundering systems, make structural changes such as new leadership and reporting relationships, and executive compensation changes such as bonus claw backs and deferments.[16]

HSBC included a statement within the DPA noting that it had already begun to address its compliance issues:

> Management has made significant strides in improving "tone from the top" and ensuring that a culture of compliance permeates the institution. The efforts of management have dramatically improved HSBC Bank USA's and HSBC Group's . . . compliance programs. The steps taken evidence HSBC Bank USA's and HSBC Group's current commitment to ensuring the past failures do not recur.[17] (See **Exhibit 7** for details on these risk events.)

Pressure to Change

Several factors were driving the need for change at HSBC and throughout the banking and financial services sectors of the economy. First, new non-traditional "fintech" startups were entering the banking sector, offering a range of online banking services, and competing with traditional banks for both consumer and commercial customers. These new entrants put pressure on both bank revenues, by providing banking alternatives, and on bank margins, as fintech competitors often had lower cost structures than traditional banks, with their narrow focus and cost effective operations.[18]

Another challenge was that risk management failures throughout the industry leading up to the 2008 financial crisis had led regulators to increase the levels of regulatory capital it required banks to hold. Cooke, who joined HSBC in January 2014, explained these increased capital requirements that were put in place "in order to safeguard the customers and tax payer from some of the deficiencies of the past also put a drag on the banks performance" by taking capital that would otherwise be used to grow the business. (See **Exhibit 8** for executive biographies.)

Macroeconomic factors, primarily low interest rates leading to low net interest income for banks, were also reducing bank revenues. Cooke stated, "We have been facing a perfect storm in terms of cost pressures and revenue squeezing." In the years following the financial crisis, HSBC had expanded its compliance staffing by an order of magnitude. Cooke continued, "Compliance has become a competitive factor to the industry and doing compliance well, that is being effective and efficient, would be a competitive advantage for any firm. We need to find new ways and new mechanisms to ensure safe operations, but safe operations in a very efficient way. The old ways of trying to put more people on the problem are no longer viable."

Cooke indicated that he needed to provide HSBC's Board of Directors evidence that the investment they had made in risk management was producing results—better controls that would be effective in the bank's widespread and complex operations, and fewer risk events with the potential to impact the bank's reputation and incur fines from regulators.

Keeping up with the cultural aspects of risk management raised other challenges. As HSBC grew, both geographically and with more products and services, its business became more complex. Cooke explained:

> At HSBC, as in banking and other industries generally, we pushed our processes and activities out into countries with lower-cost talent—whether they were internal operations or outsourced operations—and this increased the need for collaboration across the chain. However, I believe that the further out something gets pushed, the less collaboration exists between teams. As the value chain get longer and more complex, there is less curiosity to understand the integrity of the end-to-end operations, and then less curiosity for end-to-end risk management.

Cooke further explained that the cultural differences across the countries HSBC operated in were significant. He stated, "There are very hierarchical cultures, other cultures with free flowing questioning, and others that are very entrepreneurial. Each brings its own set of challenges in risk management."

Operational Risk Management Framework and 3LoD

HSBC employed an operational risk management framework as its overarching approach for managing operational risk.[19] Its purpose was to "identify and manage [HSBC's] non-financial operational risks in an effective manner; remain within the Group's operational risk appetite,[a] which helps the organization understand the level of risk it is willing to accept; and drive forward-looking risk awareness and assist management focus."[20] Operational risks, also called non-financial risks, consisted of a wide range of risks such as fraud, compliance, legal, reputation damage, system failures, process errors, unauthorized activities, errors, omissions, political, tax, accounting, natural disasters, terrorism, and others, whether from internal or external causes. The traditional financial risks, such as credit risks, interest rate risks, currency risks, and liquidity risks, had always been important, but these risks were different than operational risks. The incidents of money laundering and client tax evasion at HSBC were examples of operational risks.

HSBC employed a 3LoD model at the heart of its operational risk management framework. The 3LoD model defined "who is responsible to do what to identify, assess, measure, manage, monitor, and mitigate operational risks, encouraging collaboration and enabling efficient coordination of risk and control activities."[21] (See **Exhibit 9** for a depiction of HSBC's 3LoD model.) One article on 3LoD noted, "The model promotes risk ownership and a stronger risk management culture while eliminating inefficiencies, gaps and overlaps that often occur in the management of risk and compliance by multiple functions."[22] Some financial firms that had implemented 3LoD also instituted incentive compensation plans in which healthy risk measures were as important as financial performance for determining executive bonus levels.[23]

HSBC had a long history in developing and employing risk management systems. Indeed, the 3LoD model had been pioneered by KPMG, a leading public company auditing firm, for HSBC in the U.K. in the 1990s.[24] While 3LoD models had existed for some time, the method gained importance in 2011

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[a] HSBC defined risk appetite as "the quantum of risk the bank is willing to accept in achieving its medium and long term goals." HSBC's risk appetite was approved at the board level and aligned with the bank's strategy.

when the Basel Committee on Banking Supervision published a set of principles on the sound management of operational risk, which included the 3LoD model.[25] In early 2013, the Institute of Internal Auditors, a leading audit professional organization, referred to 3LoD as a "best practice" in risk management and control.[26] In late 2014, the Basel Committee surveyed 60 significant banks and found 55 of the 60 had fully or substantially implemented 3LoD.[27]

Regulators and the Monitor In April 2014, the U.S. Department of Justice issued a filing about the activities of the DPA Monitor at HSBC. A Reuters article at the time quoted the Monitor as saying, "The Monitor believes that the leadership of HSBC Group is appropriately committed to addressing the Bank's longstanding compliance deficiencies," but also that there was "much work to be done."[28] Also in 2014, HSBC received a regulatory letter that required the bank to develop a new operational risk management framework. In April 2015, the Monitor reported that while HSBC had made significant progress, he believed that progress was too slow. The Monitor singled out the bank's compliance culture as an ongoing issue, noting that top executives seemed to be onboard, but resistance remained in some parts of the business, including the U.S.[29]

Operational Risk Management Framework Transformation

Prior to 2015, HSBC had implemented a traditional 3LoD model where the business was the first line of defense and the supporting functions were the second line of defense, but by the time Cooke arrived at HSBC in 2015, it was recognized that this model was not working and was causing confusion, particularly in the functions. This led HSBC to launch an operational risk management transformation program aimed at simplifying and improving its management of operational risk. The transformation program would provide transparency and focus on HSBC's highest operational risks in order to reduce the bank's overall risk profile, lower costs, improve customer experience, meet regulatory expectations, and avoid reputational damage, regulatory sanctions, and customer harm. It would also standardize a common risk management framework (processes, tools, practices) for operational risk. Better control of risks also meant HSBC could hold less capital to safeguard its operations and meet regulatory requirements, which in turn left more capital for HSBC to invest in growth.[30]

As part of this transformation, Cooke implemented an activity-based 3LoD model, which clarified that it was the role the individual employee undertook—not where they sat in the organization—that drove which line of defense they were in. HSBC also created five core roles to support this model across the first two lines of defense. (See **Exhibit 10** for the model's five core roles and **Exhibit 11** for additional details on the roles.)

The rollout of the transformation program consisted of meetings and communications with all employees in 2015 to make them aware of 3LoD and its use at HSBC. In 2015 and 2016, HSBC provided role-specific communication and training to those that held core roles within 3LoD.[31] While each of the three lines of defense worked collaboratively, they each had different responsibilities; one line was not a backup for another.

Culture played a significant role in HSBC's 3LoD transformation, as to embed the model was all about employee behavior and their ownership of risk management activities. HSBC conducted training on culture, including day-long sessions on values, asking for feedback, and speaking up. In addition, HSBC worked to create a strong risk culture—"norms, attitudes and behaviors related to risk awareness, risk taking and risk management."[32] Cooke explained, "A key part of the 3LoD transformation is its focus on soft skills. We are trying to change how people think about their roles. Does our culture include curiosity? Does it care about risk and the impact on our customers? Does it see the bigger picture and consider the long term? Or is it very narrow or operating in silos?"

Challenges with 3LoD

While the 3LoD model provided clear roles and responsibilities for each employee in a way that ensured each line complemented the others, there were, however, several challenges to operating a well-functioning 3LoD system.

One challenge was that it required the first line of defense to perform two sometimes-conflicting roles. First line personnel were the client-facing, business-focused individuals responsible for bringing in revenues for the bank. These same people also had risk management responsibilities to make sure they followed HSBC compliance policies and procedures relating to regulatory requirements.

A second challenge related to the relationships between the first line of defense and the second. The second line developed the policies and guidelines for managing risks and its personnel consisted of the risk stewards and operational risk functions. Second line personnel were a partner for the first line, helping them understand and manage risk management issues, but the second line also played an oversight role, watching over the first line and making sure first line personnel followed the rules to ensure safe operations. This could result in tension between the first line and the second line.

Third, there were challenges relating to the third line, internal audit, whose role was to ensure that the overall risk management framework and control systems were designed and operating effectively, and that the first line and the second line were performing their roles. For internal audit, it was a big job, difficult to perform, and included significant manual processes. Further, as a cost center, the internal audit function competed for limited resources.

Finally, 3LoD was inherently a human interaction system and did not provide a clear signal as to how well it was working. It had no well-recognized metric. Traditional measures to assess the effectiveness of the 3LoD model did not directly asses the 3LoD model itself but rather the indirect impacts that the model had upon the traditional risk management metrics, such as the operational losses, number of related audit points and the identification and assessment of broken control systems. When Cooke was asked whether HSBC's 3LoD transformation was a success, he could only point to traditional measures such as reducing loss trends, measures that are often backward looking. Jenny Birdi, U.K. head of operational risk and risk strategy, explained, "With traditional methods of control, it is very difficult to know, for example, whether the risk stewards are being effective in their roles. Are they communicating enough with the risk owners, and are they doing it by email, by phone, in-person, or some other way. Personally, I ask them, but that is very difficult to do on any systematic basis." Cooke added that 3LoD was really about getting the people part right. He continued:

> Do people know the role they play in stopping the organization from failing? It starts with the first line. They must care about what can go wrong and do everything to stop it. If you don't get that culture right, you're already in a world of pain. The second line must provide guidance, but be independent enough to challenge the first line and verify it is prioritizing the right things. And the third line must be independent enough to look at the activities between the first and second lines and ensure there are adequate systems of control. Many people are hung up on the details of 3LoD, but it really comes down to the human factor.

A Regtech Solution

Regtech as a technology and a business model had emerged in recent years with many leading firms founded since 2012.[33] In late 2016, one industry CEO commented on the development of the technology: "Regtech is another example of an industry that is being changed rapidly by software. There has been technology used at various levels in the Regulatory space for over 20 years. However, what the new regtech [model] recognizes is that the gap between software and non-software enabled services has widened significantly."[34]

HSBC was considering a regtech system developed by a startup company that looked at trust networks among HSBC employees as exhibited in their communication networks: which employees communicated with which other employees, how frequently, and when. The system did this by examining the email traffic metadata, e.g. who communicated with whom, when, and how frequently, and other such details, but without touching the content of the email or even email subject lines. The system identified patterns, and changes in patterns, for email traffic both historically and continuously over time. Certain such patterns acted as leading indicators of potential problems, and alerted risk managers to areas of concern that they could then investigate proactively, before problems erupted. The idea was that because the three lines should be working together, and especially the first and second lines together, the communication pattern would be seen in the data. Birdi explained, "It would become clear whether the risk owners in the first line of defense were communicating with the risk stewards in the second line, and vice versa." Cooke added, "With the volume of data being studied, it would be very difficult for anyone to 'game' the system because you would have to understand how the data is being used and what signals it is creating about you and your team. Then you would have to sustain that gaming over a prolonged period because it is being collected day in and day out."

The startup's regtech system looked at broad patterns, how everyone communicated with everyone and how teams communicated internally more so than how one specific person communicated with another specific person. HSBC would also be able to input into the regtech system data from the risk incidents that had occurred at the bank in the past. In addition to email communications metadata, this additional data would be used to train and improve the accuracy of the system.

The regtech system would also provide a metric—distilled from the communications patterns within the bank—that would indicate how well HSBC's 3LoD model was working. This would help Cooke evaluate 3LoD and provide assurances to the board of directors that HSBC's investments in its resources and control systems were delivering results. Cooke explained:

> The strength of a 3LoD system lies in the human factors and risk culture. A regtech system using big data would sit on top of that and provide signals that indicate whether the proper human factors and risk cultures are in place and functioning well. We would not be trying to find bad people, but rather to find people who need help. We would not be trying to detect a rogue actor. Instead, we would be looking for people who do not have the right curiosity, awareness, and sense of ownership and who are not doing their job as well as they could. They're not being a professional risk manager or a business manager who really gets risk. We can use regtech to find areas of concern and then intervene before a real problem occurs.

While the startup company had developed a seemingly powerful system based on generally accepted social science theories that were backed by independent research, Cooke had more to consider than just whether the system worked. The startup, like many competitors in regtech, was small and had limited experience and financial backing. Since its founding, the company had developed a few products, primarily for the human resources market. Finding the human resources market crowded, however, the startup was trying to transition to the regtech space in the banking industry where it believed it had greater prospects. Cooke believed that the company's system and approach, while untested, had the potential to work better than any other regtech or non-regtech method available, and was the only system that might identify problem areas before a risk event happened.

HSBC typically dealt with larger, established service providers and Cooke understood that HSBC might not move as quickly as an underfunded startup might need. Cooke was concerned that the startup could collapse before its product was ready. He also understood, however, that if the product worked as promised, the underfunded startup could become a $100 million plus banking regtech market leader almost overnight should it sign a contract with a leading bank such as HSBC.

The Pilot

In early 2018, Cooke and HSBC decided to partner with the regtech startup to run a pilot project in a part of HSBC's U.S. business unit. Cooke selected this unit because he knew the U.S. to be more mature and as such he thought he knew what the pilot would show there.

It took HSBC nearly a year to gather the necessary data for the pilot. Doing so required obtaining numerous internal signoffs to use the data, and then figuring out how to extract the data from HSBC's systems. In the end, HSBC provided approximately eight million metadata records, a very small sample of the data that was available, to its regtech solutions provider partner. The partner would then run the data through its technology to study communication patterns. For the pilot, HSBC provided one year of historical communications metadata. Using only historical data meant that HSBC employees could not attempt to manipulate the pilot in any way.

HSBC's regtech partner took two months to refine its algorithm, churn through the data, and begin to produce results. During this time, HSBC was able to ask its partner to take different cuts of the data and explore more questions. Cooke explained that this was a real learning experience for HSBC. He stated, "At the beginning, we thought that the partner had a product ready to go, however the product was not an off-the-shelf point solution but, rather, an analytics engine that needs to be pointed towards specific questions of interest, and calibrated to address those successfully. Hence, this was a different sort of relationship—one that required a close partnership between the regtech and their customer from the start. They had some very experienced individuals who knew how to use the algorithm to look for patterns in the data. It was not a product in the traditional sense; rather we had more of a joint development relationship. We had to figure out what hypothesis we wanted them to test."

The regtech partner looked for patterns in HSBC's metadata that correlated with patterns in the bank's risk control data. As part of its traditional operational risk management framework, HSBC conducted risk and control assessments (RCAs) throughout its businesses. The bank conducted its RCAs at least annually, but its approach was to dynamically refresh their material RCAs whenever any trigger event occurred. Trigger events included management monitoring of controls, a significant loss at the bank, discovery of a control weaknesses in a particular area of the bank by the second line or internal audit, even a significant loss at a peer bank could be a trigger to assess a risk and its controls.

At the start of the pilot, Birdi recalled, "We thought the pilot would confirm our suspicions about what was going on, but we hoped it would give us hard evidence, and not just suspicions. We also hoped we would see some patterns that we did not know were there." The regtech system also might allow for some experimentation. Birdi continued, "Because the system can analyze such large volumes of data so quickly, we hope to be able to very quickly test and discard a hypothesis in a way not possible through our traditional methods."

By mid-2019, the regtech partner provided HSBC with early results of the pilot. On one issue, the pilot showed that, as Cooke had anticipated, outsourcing an activity or service, whether internal (from one HSBC unit to another) or external (from HSBC to an external service provider), led to less engagement and collaboration. Cooke had known from experience that risk events happen more frequently in areas where risk managers were remote from their outsourced activities. The pilot also linked changes in email activity patterns to risk. For example, individuals in key roles receiving emails from fewer people than the norm might be a sign of those people being less engaged by their peers. The pilot also showed a correlation between teams that had certain frequencies of emails outside of normal working hours with upticks in the frequencies of RCAs, suggesting more active risk management. (See **Exhibit 12** for selected pilot findings.)

A Decision

Overall, Cooke believed that regtech would be a good addition to the bank's systems for risk management and regulatory compliance and that expanding its use would help HSBC better understand the potential benefits and challenges with the technology. He stated, "I believe there is more opportunity than downside in using big data and regtech solutions. It would enable us to connect more dots and get great insights in a much more efficient and effective way." At the same time, Cooke recognized the challenges would be significant:

> One of the challenges of using new technology is you're having to embark on something that is highly unproven, where you're experimenting with what the technology is actually going to deliver for you. In large organizations, which are invariable more bureaucratic and less agile organizations, that is a hard sell. Because many people prefer the more tried, true, and tested systems where it's easy to point to what has been done elsewhere and how it worked. When you're at the frontier of innovation it becomes a lot more difficult, particularly when you're trying to innovate around observing human behavior and how people collaborate. You realize this is social science where the findings have blurred edges.

The decision to explore new methods of risk management came in the context of its existing methods and expenses. In 2017, HSBC's chief executive indicated that the bank "was spending $3 billion a year on regulatory and compliance programs."[35]

Cooke wondered whether he was ready to move this forward. If HSBC decided to implement the regtech solution, how might Cooke convince the employees that monitoring their communications would be valuable? Not everyone would think that improving the culture would come from analyzing the communication of employees. Some would view this as intrusive and would see it as surveillance. Cooke also thought about what other effects the technology might have on HSBC. He stated, "There is always a debate in terms of replacing human experience with new technologies, and the extent to which we can use big data and machine learning to replace some of the traditional mechanisms. This is a debate the industry is still grappling with."

Should HSBC jump in to this new technology and remain on the leading edge of risk management systems, or should the bank give this technology more time to develop? Would a regtech system provide the evidence to allow Cooke to justify the significant investment the bank had made in recent years in its operational risk management framework and 3LoD? Finally, Cooke asked himself whether he was ready to go to the board and executives to ask them to roll out a regtech solution, and whether he himself was ready to sign a new contract with the regtech startup. After all, HSBC had run the pilot in only one unit in one country. Cooke did not know whether the system would detect all types of risk or risks at all levels of the firm or how the approach would sustain itself in the long term.

Exhibit 1 Ten Largest Banks by Total Assets (2018)

	Bank	Headquarters	Accounting Principle[a]	Assets[b] ($ trillions)
1	Industrial & Commercial Bank of China Ltd.	China	IFRS	$4.01
2	China Construction Bank Corp.	China	IFRS	$3.40
3	Agricultural Bank of China Ltd.	China	IFRS	$3.23
4	Bank of China Ltd.	China	IFRS	$2.99
5	Mitsubishi UFJ Financial Group Inc.	Japan	Japanese GAAP	$2.77
6	JPMorgan Chase & Co.	U.S.	U.S. GAAP	$2.53
7	HSBC Holdings PLC	U.K.	IFRS	$2.52
8	BNP Paribas SA	France	IFRS	$2.35
9	Bank of America Corp.	U.S.	U.S. GAAP	$2.28
10	China Development Bank	China	IFRS	$2.20

Source: Compiled from "Top 100 Banks in the World," Relbanks, April 2018, https://www.relbanks.com/worlds-top-banks/assets; and "S&P Global Market Intelligence Ranks Largest 100 Banks in the World," NextFinance, April 2016, https://www.next-finance.net/S-P-Global-Market-Intelligence,9699, both accessed June 2019.

[a] IFRS = International Financial Reporting Standards; GAAP = Generally Accepted Accounting Principles.

[b] Assets from each bank's most recently completed financial year as of April 2018.

Exhibit 2 Income Statement (years ended December 31, $ millions)

	2018	**2017**	**2016**
Net interest income	30,489	28,176	29,813
- interest income	49,609	40,995	42,414
- interest expense	(19,120)	(12,819)	(12,601)
Net fee income	12,620	12,881	12,777
- fee income	16,044	15,853	15,669
- fee expense	(3,424)	(3,042)	(2,892)
Net income from financial instruments held for trading or managed on a fair value basis	9,531	8,426	7,521
Net income/(expense) from assets and liabilities of insurance businesses, including related derivatives, measured at fair value through profit or loss	(1,488)	2,836	1,262
Changes in fair value of long-term debt and related derivatives	(97)	155	(1,997)
Changes in fair value of other financial instruments mandatorily measured at fair value through profit or loss	695	N/A	N/A
Gains less losses from financial investments	218	1,150	1,385
Dividend income	75	106	95
Net insurance premium income	10,659	9,779	9,951
Other operating income/(expense)	885	337	(971)
Total operating income	63,587	63,776	59,836
Net insurance claims and benefits paid and movement in liabilities to policyholders	(9,807)	(12,331)	(11,870)
Net operating income before change in expected credit losses and other credit impairment charges/Loan impairment charges and other credit risk provisions	53,780	51,445	47,966
Change in expected credit losses and other credit impairment charges	(1,767)	N/A	N/A
Loan impairment charges and other credit risk provisions	N/A	(1,769)	(3,400)
Net operating income	52,013	49,676	44,566
Employee compensation and benefits	(17,373)	(17,315)	(18,089)
General and administrative expenses	(15,353)	(15,707)	(16,473)
Depreciation and impairment of property, plant and equipment	(1,119)	(1,166)	(1,229)
Amortisation and impairment of intangible assets	(814)	(696)	(777)
Goodwill impairment of Global Private Banking – Europe	—	—	(3,240)
Total operating expenses	(34,659)	(34,884)	(39,808)
Operating profit	17,354	14,792	4,758
Share of profit in associates and joint ventures	2,536	2,375	2,354
Profit before tax	19,890	17,167	7,112
Tax expense	-4,865	-5,288	-3,666
Profit for the year	15,025	11,879	3,446

Source: HSBC Holdings plc, Annual Report and Accounts 2018, p. 214, https://www.hsbc.com/investors/results-and-announcements/annual-report, accessed June 2019.

Exhibit 3 Balance Sheet (years ended December 31, $ millions)

	2018	2017
Assets		
Cash and balances at central banks	162,843	180,624
Items in the course of collection from other banks	5,787	6,628
Hong Kong Government certificates of indebtedness	35,859	34,186
Trading assets	238,130	287,995
Financial assets at fair value through profit or loss	41,111	N/A
Financial assets designated at fair value	N/A	29,464
Derivatives	207,825	219,818
Loans and advances to banks	72,167	90,393
Loans and advances to customers	981,696	962,964
Reverse repurchase agreements – non-trading	242,804	201,553
Financial investments	407,433	389,076
Prepayments, accrued income and other assets	110,571	67,191
Current tax assets	684	1,006
Interests in associates and joint ventures	22,407	22,744
Goodwill and intangible assets	24,357	23,453
Deferred tax assets	4,450	4,676
Total assets	2,558,124	2,521,771
Liabilities and equity		
Liabilities		
Hong Kong currency notes in circulation	35,859	34,186
Deposits by banks	56,331	69,922
Customer accounts	1,362,643	1,364,462
Repurchase agreements – non-trading	165,884	130,002
Items in the course of transmission to other banks	5,641	6,850
Trading liabilities	84,431	184,361
Financial liabilities designated at fair value	148,505	94,429
Derivatives	205,835	216,821
Debt securities in issue	85,342	64,546
Accruals, deferred income and other liabilities	97,380	45,907
Current tax liabilities	718	928
Liabilities under insurance contracts	87,330	85,667
Provisions	2,920	4,011
Deferred tax liabilities	2,619	1,982
Subordinated liabilities	22,437	19,826
Total liabilities	2,363,875	2,323,900
Equity		
Called up share capital	10,180	10,160
Share premium account	13,609	10,177
Other equity instruments	22,367	22,250
Other reserves	1,906	7,664
Retained earnings	138,191	139,999
Total shareholders' equity	186,253	190,250
Non-controlling interests	7,996	7,621
Total equity	194,249	197,871
Total liabilities and equity	2,558,124	2,521,771

Source: HSBC Holdings plc, Annual Report and Accounts 2018, p. 216, https://www.hsbc.com/investors/results-and-announcements/annual-report, accessed June 2019.

Exhibit 4 HSBC Global Businesses 2018 (year ended December 31, $ millions)

Retail Banking and Wealth Management	Commercial Banking	Global Banking and Markets	Global Private Banking
We help 38 million customers across the world to manage their finances, buy their homes, and save and invest for the future. Our HSBC Premier and Advance propositions are aimed at mass affluent and emerging affluent customers who value international connectivity. For customers with simpler banking needs, we offer a full range of products and services reflecting local requirements.	We support approximately 1.5 million business customers in 53 countries and territories, ranging from small enterprises focused primarily on their domestic markets, through to large companies operating globally. Our services include working capital, term loans, payment services and international trade facilitation, as well as expertise in mergers and acquisitions, and access to financial markets.	We serve approximately 4,100 clients in more than 50 countries and territories. We support major government, corporate and institutional clients worldwide. Our product specialists continue to deliver a comprehensive range of transaction banking, financing, advisory, capital markets and risk management services.	We serve high net worth and ultra high net worth individuals and families, including those with international banking needs. Services provided include Investment Management, which includes advisory and brokerage services, and Private Wealth Solutions, which comprises trusts and estate planning, to protect and preserve wealth for future generations.

	Retail Banking and Wealth Management	Commercial Banking	Global Banking and Markets	Global Private Banking	Corporate Centre	Total
Net operating income/(expense)	20,758	14,146	15,538	1,793	(62)	52,173
Total operating expenses	(13,711)	(6,477)	(9,460)	(1,449)	(1,893)	(32,990)
Operating profit/(loss)	7,047	7,669	6,078	344	(1,955)	19,183
Share of profit in associates and joint ventures	33	—	—	—	2,503	2,536
Adjusted profit before tax	7,080	7,669	6,078	344	548	21,719
Share of HSBC's adjusted profit before tax	32.6%	35.3%	28.0%	1.6%	2.5%	100.0%
Adjusted cost efficiency ratio	62.5%	43.5%	61.0%	81.2%	(1,069.5%)	61.2%
Adjusted balance sheet data						
Loans and advances to customers (net)	361,872	333,162	244,978	39,217	2,467	981,696
Interests in associates and joint ventures	397	—	—	—	22,010	22,407
Total external assets	476,784	360,216	1,012,272	43,790	665,062	2,558,124
Customer accounts	640,924	357,596	290,914	64,658	8,551	1,362,643
Adjusted risk-weighted assets (unaudited)	126,865	321,244	281,021	16,824	118,550	864,504

Source: HSBC Holdings plc, Annual Report and Accounts 2018, pp. 3 and 48, https://www.hsbc.com/investors/results-and-announcements/annual-report, accessed June 2019.

Exhibit 5 HSBC Geographic Performance 2018 (year ended December 31, $ millions)

	Europe	Asia	MENA[a]	North America	Latin America	Intra-HSBC	Total
Net interest income	6,841	16,108	1,763	3,521	2,020	236	30,489
Net fee income	3,996	5,676	607	1,854	498	(11)	12,620
Net income from financial instruments held for trading or managed on a fair value basis	3,942	4,134	285	728	736	(294)	9,531
Net income from assets and liabilities of insurance businesses, including related derivatives, measured at fair value through profit and loss	(789)	(717)	—	—	18	—	(1,488)
Changes in fair value of other financial instruments mandatorily measured at fair value through profit or loss	601	(26)	(1)	36	27	58	695
Other income	3,113	3,609	33	586	(237)	(5,171)	1,933
Net operating income before change in expected credit losses and other credit impairment charges/recoveries	17,704	28,784	2,687	6,725	3,062	(5,182)	53,780
Change in expected credit losses and other credit impairment charges/recoveries	(609)	(602)	(209)	223	(570)	—	(1,767)
Net operating income	17,095	28,182	2,478	6,948	2,492	(5,182)	52,013
Total operating expenses	(17,934)	(12,466)	(1,357)	(6,149)	(1,935)	5,182	(34,659)
Operating profit/(loss)	(839)	15,716	1,121	799	557	—	17,354
Share of profit in associates and joint ventures	24	2,074	436	—	2	—	2,536
Profit/(loss) before tax	(815)	17,790	1,557	799	559	—	19,890
Share of HSBC's profit before tax	(4.1%)	89.5%	7.8%	4.0%	2.8%		100.0%
Cost efficiency ratio	101.3%	43.3%	50.5%	91.4%	63.2%		64.4%
Balance sheet data							
Loans and advances to customers (net)	373,073	450,545	28,824	108,146	21,108	—	981,696
Total assets	1,150,235	1,047,636	57,455	390,410	51,923	(139,535)	2,558,124
Customer accounts	503,154	664,824	35,408	133,291	25,966	—	1,362,643
Risk-weighted assets	298,056	363,894	56,689	131,582	38,341	—	865,318

Source: HSBC Holdings plc, Annual Report and Accounts 2018, p. 55, https://www.hsbc.com/investors/results-and-announcements/annual-report, accessed June 2019.

[a] MENA = Middle East and North Africa.

Exhibit 6 Simplified Risks and Controls: HSBC Training Document

Risk is the probability that the actual outcome from an activity differs from what was expected.

Controls are the things we put in place to prevent, manage and reduce risk.

SAY:
- Risk and control management is, at heart, a simple concept.
- Think about a hot cup of coffee…

ASK:
- What are the risks involved with drinking a cup of hot coffee?
- And what might be some of the controls we put in place to prevent or minimize those risks?
    - E.g. Apply a lid, blow on the coffee before drinking, take small sips first to test the heat, use a cup holder, add extra milk/cold water

SAY:
- For someone who loves a cup of morning coffee, giving up coffee is not a viable solution to managing the risk of getting scalded.
- Similarly, banks who don't take risks go out of business!
- Doing business is fundamentally about taking considered risks within an effective framework of controls to manage them.
- Every employee at HSBC is responsible for the risks that are part of their day-to-day job.

Our job is to effectively manage those risks, which is where three lines of defense comes in.

Source: Company documents.

Exhibit 7 HSBC Historical Risk Events and Regulatory Penalties 2007-2018 ($)

Penalty Year	Company	Primary Offense	Penalty Amount
2007	HSBC	wage and hour violation	$16,545
2007	HSBC Bank USA, N.A.	investor protection violation	$10,500,000
2009	HSBC Auto Finance	wage and hour violation	$420,000
2010	HSBC North America	environmental violation	$36,083
2012	HSBC	toxic securities abuses	$5,250,000
2012	HSBC Bank USA, N.A.	banking violation	$500,000,000
2012	HSBC HOLDINGS PLC	banking violation	$165,000,000
2012	HSBC Holdings	economic sanction violation	$375,000,000
2012	HSBC Holdings plc HSBC Bank USA N.A.	anti-money-laundering deficiencies	$1,256,000,000
2013	HSBC Bank USA, National Association	banking violation	$249,000,000
2013	HSBC Bank	wage and hour violation	$15,625,000
2014	HSBC	mortgage abuses	$10,000,000
2014	HSBC Bank	interest rate benchmark manipulation	$275,000,000
2014	HSBC North America Holdings Inc.	toxic securities abuses	$550,000,000
2014	HSBC Private Bank (Suisse)	investor protection violation	$12,500,000
2016	HSBC Bank USA NA	mortgage abuses	$470,000,000
2016	HSBC Bank USA, National Association	banking violation	$35,000,000
2016	HSBC Finance Corporation	Servicemembers Civil Relief Act	$434,500
2016	HSBC North America Holdings, Inc.	banking violation	$131,000,000
2016	HSBC	wage and hour violation	$6,982,000
2017	HSBC TOWER	environmental violation	$5,000
2017	HSBC Bank USA, National Association	banking violation	$32,500,000
2017	HSBC Holdings	banking violation	$175,000,000
2017	HSBC Bank USA N.A.	False Claims Act	$2,118,861
2018	HSBC Holdings plc	fraud	$100,000,000
2018	HSBC Securities (USA) Inc.	securities issuance or trading violation	$1,600,000
2018	HSBC	toxic securities abuses	$765,000,000
Total			**$5,143,987,989**

Source: Violation Tracker, https://violationtracker.goodjobsfirst.org/prog.php?parent=hsbc, accessed July 2019.

Exhibit 8 Executive Biographies

Mark Cooke, Group Head of Operational Risk

Mark joined HSBC in 2014 as the Group Head of Operational Risk from Barclays where he was previously the Chief Risk Officer for Barclays Wealth and Investment Management. Prior to that, Mark held a number of Managing Director roles in Risk, Strategy and Operations for UBS Investment Bank, both in the UK and USA.

He is the current President and Chair of The Operational Risk Data Exchange (ORX), the Financial Services Industry Association for Operational Risk Management.

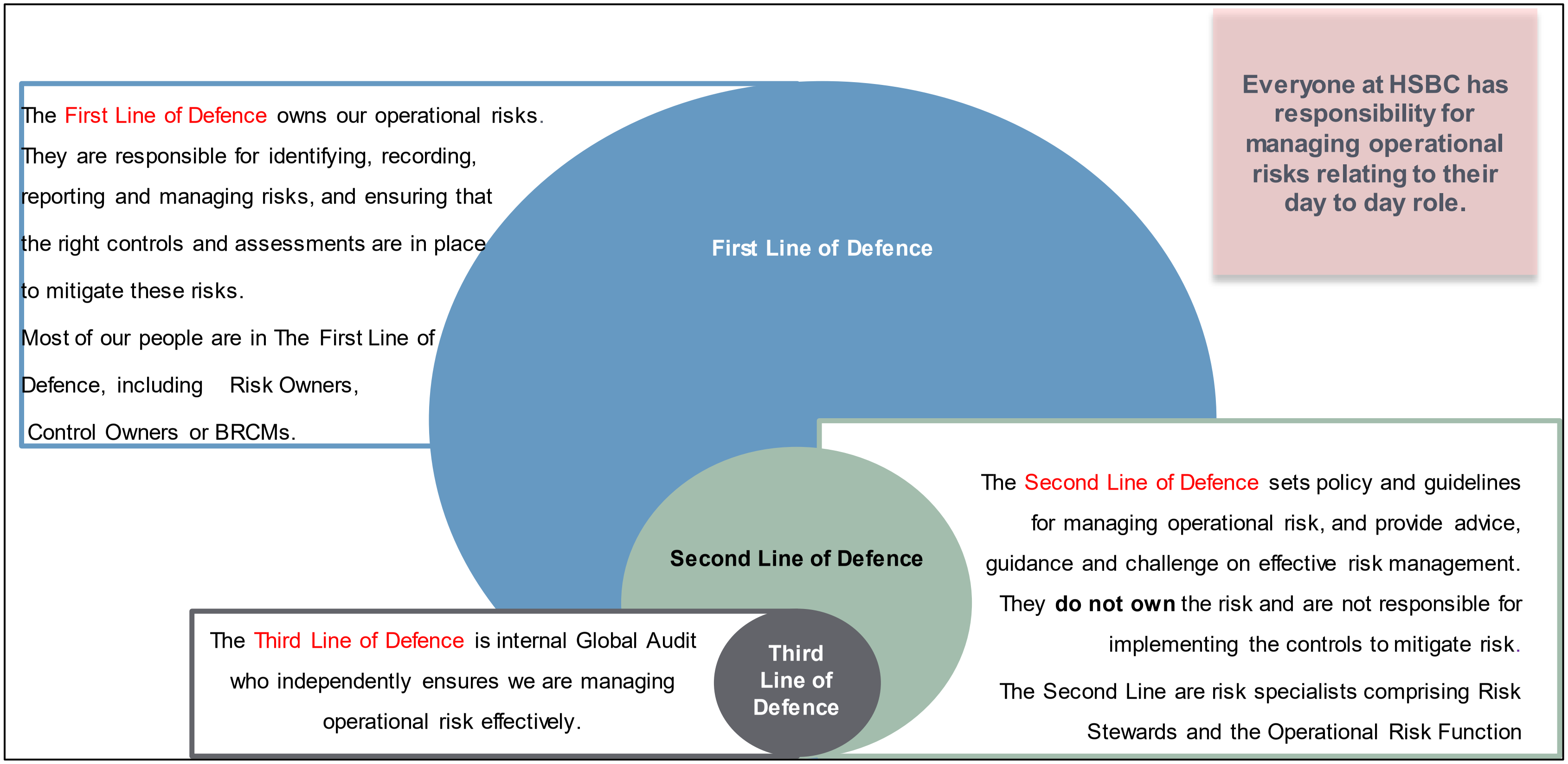
Mark has been a Chartered Accountant of the Institute of Chartered Accountants in England and Wales since 1992.

Dr. Jenny Birdi, U.K. Head of Operational Risk and Risk Strategy

Jenny has been with HSBC for over 25 years, having joined the Group through Forward Trust (also located in Birmingham) in 1993. She is currently the Head of Operational Risk and Risk Strategy for the UK ring fenced bank, having been appointed to this double-hatted role in April 2018. She was previously the Head of Three Lines of Defense Execution for Operational Risk. Jenny has spent nearly a decade in various roles in Operational Risk, interspersed with significant experience in Internal Audit (over 10 years' experience) and IT, including a one year secondment to Vietnam.

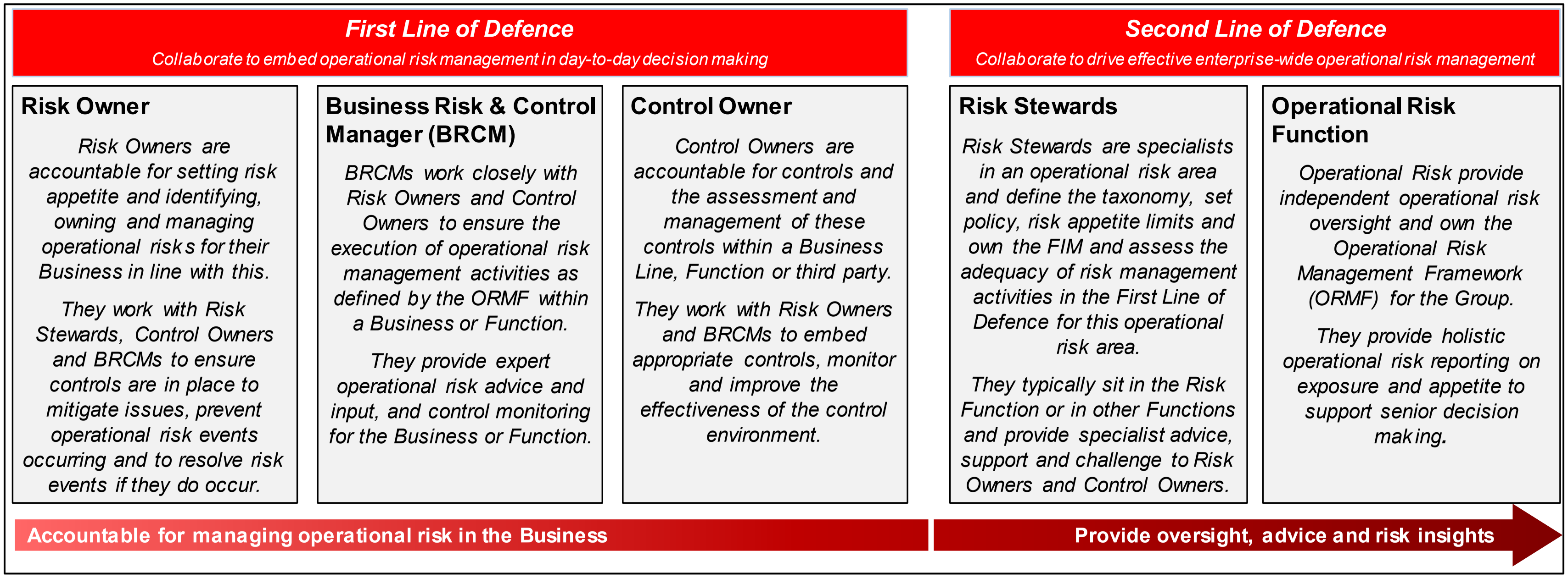
Source: Company documents.

Exhibit 9 HSBC Three Lines of Defense Model



Source: Company documents.

Exhibit 10 The Five Core Roles of 3LoD



Source: Company documents.

Note: Everyone within HSBC is part of the three lines of defense. Everyone is responsible for managing operational risks relating to their day-to-day role. This means that everyone has a role in upholding the first line of defense. Some individuals have specific first line of defense risk management responsibilities: Risk Owners, Business Risk & Control Managers, and Control Owners. The second line of defense consists of Risk Stewards and the Operational Risk Function while the third line of defense consists of internal audit. Segregation of duties will be required where individuals in the Global Functions have both First and Second Line responsibilities e.g. individuals who are both a Risk Steward and Control Owner.

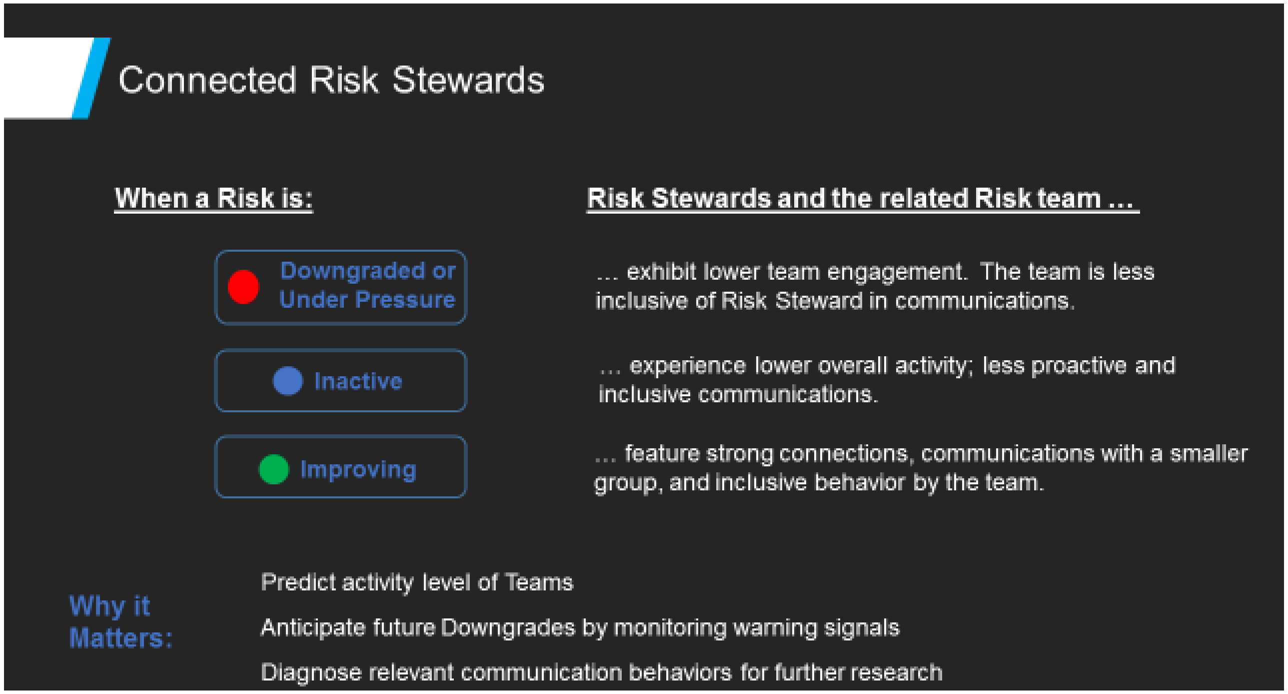
Exhibit 11 Five Core Roles Details

Operational Risk Management Framework				First Line			Second Line	
		ORMF Framework Activity	Process Description	Risk Owner	BRCM	Control Owner	Risk Steward	Op Risk
Operational Risk Management Framework	Policy & Governance	Policies and Standards *(Operational Risk)*	Set and maintain operational risk policy, standards and reference data, including taxonomy and prioritisation matrix *(Op Risk)*	I	C	I	C	A/R
		Policies and Standards *(Specific Risk Area)*	Set and maintain operational risk policy, standards and reference data, including taxonomy and prioritisation matrix *(Specific Risk Area)*	I	C	I	A/R	C
		Operational Risk Governance (GORC and above)	Govern operational risk management, providing direction, control and transparency	R	C	C	C	A
		Operational Risk Governance (Business/Function)	Govern operational risk management, providing direction, control and transparency	R	A	C	C	C
	Risk Appetite	Risk Appetite Management *(Operational Risk)*	Set and report appetite for operational risk exposure	R	C	I	C	A
		Risk Appetite Management *(Specific Risk Area)*	Set and report appetite for operational risk exposure	R	C	I	A	C
	Capital Management	Capital Modelling	Determine capital requirements and allocations for operational risk exposure	I			I	A/R
	Core Operational Risk Management	Risk and Control Assessment	Ensure risks are identified and understood, and that appropriate controls are in place	A	R	R	C	C
		Scenario Analysis	Develop robust, fact-based and forward-looking assessments of material risks	R	C	C	C	A
		Control Monitoring	Assess the ongoing effectiveness of controls put in place to manage operational risk	C	R	A	C	I
		Key Indicator Management	Set and monitor measures of operational risk and controls	R	R	R	R	A
		Internal Event Management	Identify and investigate internal losses, incidents and near-misses and consider relevance to internal controls and risk management	A	C	R	C	I
		External Event Management	Identify external losses, incidents and near-misses and consider relevance to internal controls and risk management	R	C	R	A	R
		Management Actions	Capture and monitor management responses to issues identified through other processes in the model	A/R	C	C	C	C
	Oversight, Use & Embeddedness	Operational Risk Oversight *(Operational Risk)*	Review use and adherence to policies and standards, ensuring components of the operational risk management framework are embedded into the day-to-day management of the business *(Op Risk)*	R	C	C	C	A
		Operational Risk Oversight *(Specific Risk Area)*	Review use and adherence to policies and standards, ensuring components of the operational risk management framework are embedded into the day-to-day management of the business *(Risk Area)*	R	C	C	A	C
	Reporting	Reporting	Analyse and report on operational risk management	C	R	C	C	A

Source: Company documents.

Note: R=Responsible: Completes and drives the work to achieve the activity. Multiple roles may have responsibility for elements of a process in this high-level RACI.
A=Accountable: Ensures effective completion of the activity and is held to account. Only one role can be accountable for a process.
C=Consulted: Opinions are sought in completing the activity. Multiple roles may be consulted.
I=Informed: Kept up to date with progress but do not input into the activity. Multiple roles may be informed.

Exhibit 12 Selected Pilot Results



Source: Adopted from Company documents.

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