National Audit Office

1 AUGUST 2013

HM Revenue & Customs

The HMRC VAT service: the impact of legacy ICT

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Summary

1 Value Added Tax (VAT), is charged on most goods and services in the UK as well as on goods and some services imported from countries within and outside the European Union. There are currently around 1.9 million customers registered for VAT in the UK, with total VAT receipts of £99.6 billion in 2011-12.

2 HM Revenue & Customs (HMRC) is responsible for the administration and collection of VAT. This service currently depends on a number of legacy ICT systems that provide a repository for VAT return and payment information and maintain records of customer returns and transactions. The National Audit Office examined the way HMRC manages its VAT service and the impact of legacy ICT on the delivery of this service. We found:

- The VAT ICT systems are robust and stable. The latest available statistics show that they were achieving 100 per cent availability in four of the last five months of 2011-12, and 99.8 per cent in the other month, January 2012.
- HMRC has successfully extended the life of its legacy VAT ICT systems through enhancements. For example, adding an online registration service, and updating the technology in 2011 to a more modern hardware and software solution.
- The VAT ICT systems are compliant with government security standards and have been independently assessed to accreditation requirements. Access to the systems is managed and controlled formally through the granting of appropriate user access rights, and backup and recovery capability is regularly reviewed and tested.
- HMRC has a very experienced and knowledgeable internal team to support the VAT ICT systems. However, it will become increasingly difficult to source technical skills in the legacy technology (Virtual Machine Environment (VME) and COBOL), and to develop and retain expertise in the unique complexities and characteristics of the VAT ICT systems. HMRC recognises this risk and has embarked on an exercise to recruit a number of mainframe developers and implement succession plans and knowledge transfer activities.

- The hardware environment is provided through Aspire, HMRC's ICT supply contract with Capgemini and Fujitsu. Due to the scale, age and complexity of the HMRC systems only a small number of large ICT suppliers are able to support it and this will be a consideration when the current contract comes up for renewal in 2017. There are also the Fujitsu announcements made from 2007 onwards regarding the end of support for the current VME operating system product in 2020, and its plans to offer a cloud based service as alternatives to migration. These are important issues for HMRC to consider in its future plans for the VAT system.
- HMRC has a well-defined vision for ICT and for its business tax systems which incorporate VAT. The original VAT system dates back to the 1970s and was designed as a paper-based service. The current systems still operate to the original design of processing forms in overnight batches. This has led to the creation of additional ICT systems, known as business developed applications as well as process workarounds, in response to changes in operational and policy needs.
- HMRC completed a review of the end-to-end VAT process in 2012. One aim of the review was to reduce the degree of customisation and strive to standardise processes where possible. The core VAT processes have been mapped and a number of exception processes have been identified as potential targets for efficiency improvements.
- To reduce cost and complexity in line with strategic priorities, HMRC has implemented the Enterprise Tax Management Platform (ETMP) which will serve as a strategic ICT system for all business single taxes. While no firm plans to transfer VAT to ETMP are currently in place, we found that there is an aim across the ICT team to further explore the feasibility and potential benefits of a move.
- ETMP is based on modern technology and design principles and will represent a significant change from the existing VAT ICT systems. Therefore, to maximise the probability of achieving the full benefits of a potential move, the business process review team should be involved from the early stages to improve standardisation and reduce cost and complexity.
- HMRC was still providing us with data in the very late stages of finalising this report and several months after it had originally been requested. For financial data, the late provision of data has prevented us from verifying costs and forming clear conclusions. For performance information, we saw indications that HMRC has a good set of data that it uses in its day to day management. However, we were unable to fully confirm this finding or obtain sufficient data to allow us to conclude on the performance of the VAT service. The challenges we faced in obtaining data from HMRC suggest that it may face challenges in robustly planning for the longer term.

Part One

The National Audit Office's assessment of government's legacy ICT

1.1 We define legacy ICT as systems and applications that have been operationally embedded within a business function but superseded by newer and often more effective technologies or changed business needs, for example, the need to deliver a new policy or deliver a service in a different way.

1.2 Public services that rely on legacy systems face a number of risks. Availability can be impacted through unreliability or failure of worn components. Extending public services to digital channels as per the 'digital by default' strategy as set out in the Government Digital Strategy[1] can be constrained by legacy modes of operation - processing jobs as a sequence of batches instead of reacting in real time in a way users of digital services have become accustomed. Additionally, the improvement of public services through their redesign can take longer and be more costly because the skills and knowledge that understands the function of the legacy system have been lost.

1.3 In its ICT strategy,[2] the government identified its legacy systems as acting as barriers to transforming public service delivery. These barriers stem from older systems that may use proprietary standards in their technical design that creates challenges when integrating data and processing with modern systems. Despite this, the government's stated preference is to extend the lives of such systems rather than face the risks and costs of replacing them. This was made clear in a response to the Public Administration Select Committee's (PASC) report on IT in government[3] which identified the often key role legacy systems play in public service delivery. PASC recommended that government identifies where and when investment is needed to migrate and replace legacy systems. In response, the government said it preferred to extend the life of legacy systems using software layers it called "wrappers" that would make legacy systems integrate more easily with newer systems. Subsequently the

[1] The Cabinet Office, *Government Digital Strategy*, November 2012, available at http://publications.cabinetoffice.gov.uk/digital/strategy/

[2] The Cabinet Office, *Government ICT Strategy*, 2011, available at http://www.cabinetoffice.gov.uk/sites/default/files/resources/uk-government-ict-strategy-2011_0.odt

[3] House of Commons Public Administration Select Committee, *Government and IT - "a recipe for rip-offs": time for a new approach: Further Report*, *with the Government Response to the Committee's Twelfth Report of Session 2010-12,* Twentieth Report of Session 2010-12, HC1724, January 2012.

Cabinet Office issued further advice[4] providing more detail on the approach to handling legacy ICT.

1.4 We examined how the public sector manages its legacy ICT systems in relation to service delivery. In particular, we explored public services that continue to be supported by legacy ICT for the foreseeable future.

1.5 We applied our Business Analysis Toolkit[5] to assess the impact of legacy ICT on public service performance and costs. The toolkit focuses on three areas of analysis: the service model which describes the key components of service delivery; service performance over time, with associated costs and risks; and an enterprise analysis[6] measuring how mature the organisation is in managing, operating and maintaining the service, including its legacy ICT.

1.6 This report is part of a series that examines how well government is managing those public services that rely on legacy ICT systems. There are four reports in this series:

- The consumer credit licensing service operated by the Office of Fair Trading using the 6 year old PROMOD system.
- The processing and payment of the state pension, a service delivered by the Department for Work and Pensions using the 26 year old Pension Strategy Computer System.
- The Value Added Tax (VAT) service operated by HM Revenue & Customs using a series of legacy systems that originally date back to a 40 year old VAT mainframe system.
- The prescription processing service operated by the NHS Business Services Authority using the 6 year old Capacity Improvement Programme system and its 17 year old legacy forerunner.

1.7 In Appendix Four we show how this piece of work fits in with other National Audit Office publications on government ICT.

[4] The Cabinet Office, *Government Service Design Manual*, April 2013, available at https://www.gov.uk/service-manual/technology/architecture.html#the-legacy-estate

[5] A full description of the methodology used during our fieldwork, including the components of our Business Analysis Toolkit, can be found in Appendix Two.

[6] Our enterprise analysis is performed using a framework containing the seven key areas that most impact performance: strategy, governance, implementation, service management, people, process and technology. A full description of the enterprise analysis framework we applied during our fieldwork can be found in Appendix Three.

Part Two

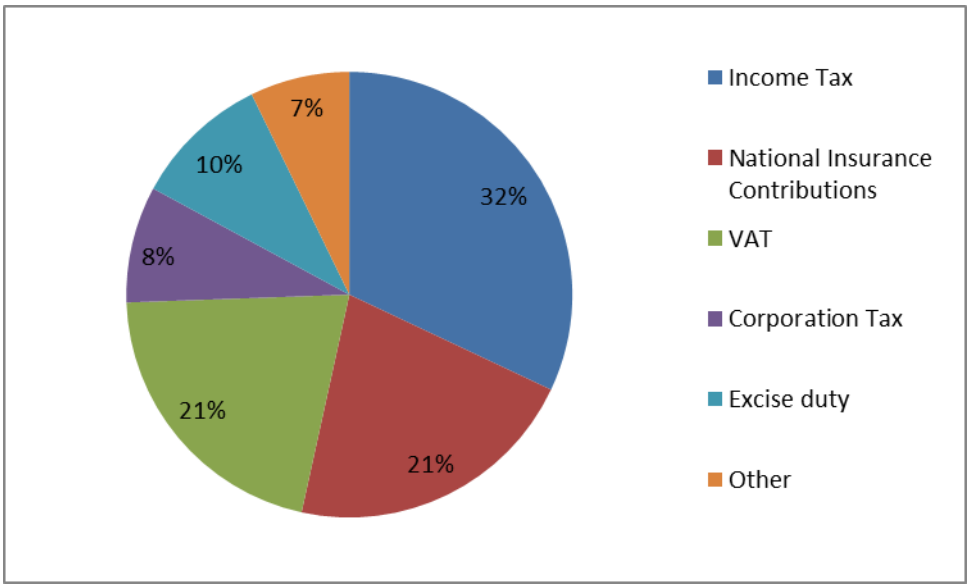
The HMRC VAT service

2.1 In 2011-12, HM Revenue & Customs (HMRC) collected a total of £474.2 billion in revenue. Of this, £99.6 billion was VAT which is charged on most goods and services that VAT-registered businesses provide in the UK. It is also charged on goods and some services that are imported from countries within and outside the European Union (EU).

Figure 1

Main types of revenue collected by HM Revenue & Customs in 2011-12 (£billion)

In 2011-12 VAT accounted for 21 per cent of total UK tax revenue (£99.6 billion)



NOTE

1. 2011-12 figures in £billion (2010-11), Other £34.2 (£32.6), Income tax £151.8 (£157.5), National Insurance contributions £101.6 (£ 96.9), VAT £99.6 (£90.3), Corporation tax £40.1 (£46.4), Excise duty £46.9 (£46.0),

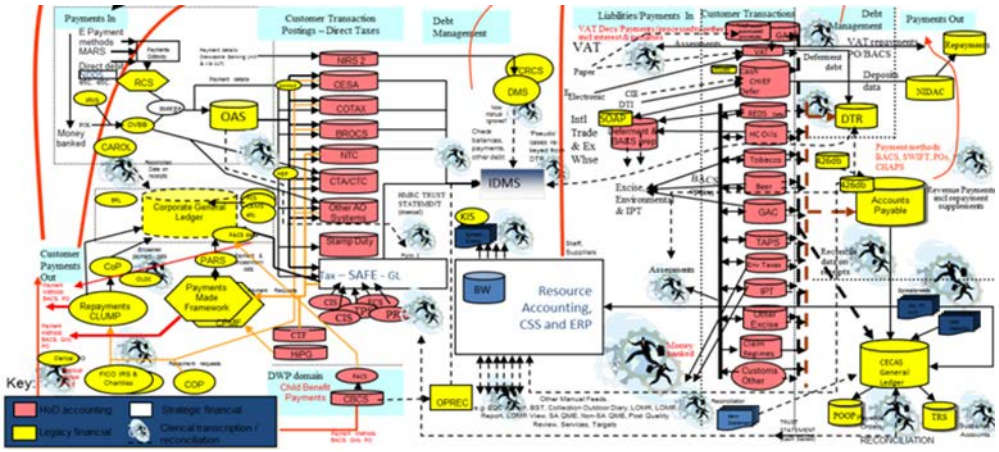
Source: HM Revenue & Customs Annual Report and Accounts 2011-12

2.2 HMRC was formed in 2005 with the merger of the Inland Revenue and HM Customs and Excise. It has described its 600 ICT systems as "complex, ageing and costly."[7] As part of implementing its IT strategy, HMRC is working to decommission old systems and consolidate current and future systems on fewer applications more suited to current needs and the delivery of the Digital agenda. HMRC has about 50 tax systems that have been developed for individual services over the last 40 years which means that HMRC's customers are recorded and identified through various means across many different systems, so that it is challenging to obtain a comprehensive single view of a customer. This complexity is illustrated in **Figure 2.**

Figure 2

Legacy ICT environment

The merger of the Inland Revenue and HM Customs and Excise in 2005 resulted in a complex and fragmented ICT environment



Source: HMRC

[7] P Pavitt, *HMRC Case Study*, HM Revenue & Customs, September 2009, available at www.gov.uk, accessed 10 April 2013.

The VAT ICT systems

2.3 The VAT service currently depends on a number of ICT systems that provide the trigger and repository for VAT return and payment information, and a record of customer returns and transactions which is reconciled against actual cash-flow (**Figure 3**). The original ICT system was a mainframe system that dated back to the 1960s to provide trade statistics, and VAT was added in 1973 when VAT was introduced. This was one of the first mainframe computers to be installed by central government. The Mainframe platform has been upgraded numerous times since the 1970s including a major re-design in 1990.

2.4 Due to the increasing scarcity of legacy coding skills, the current supplier of Virtual Machine Environment (VME), Fujitsu, announced in 2007 that it will end support for the current VME operating system product in 2020. If users of VME have not migrated their applications in this timeframe, Fujitsu plans to offer a cloud based service that will enable customers to run their legacy VME applications on modern infrastructure.

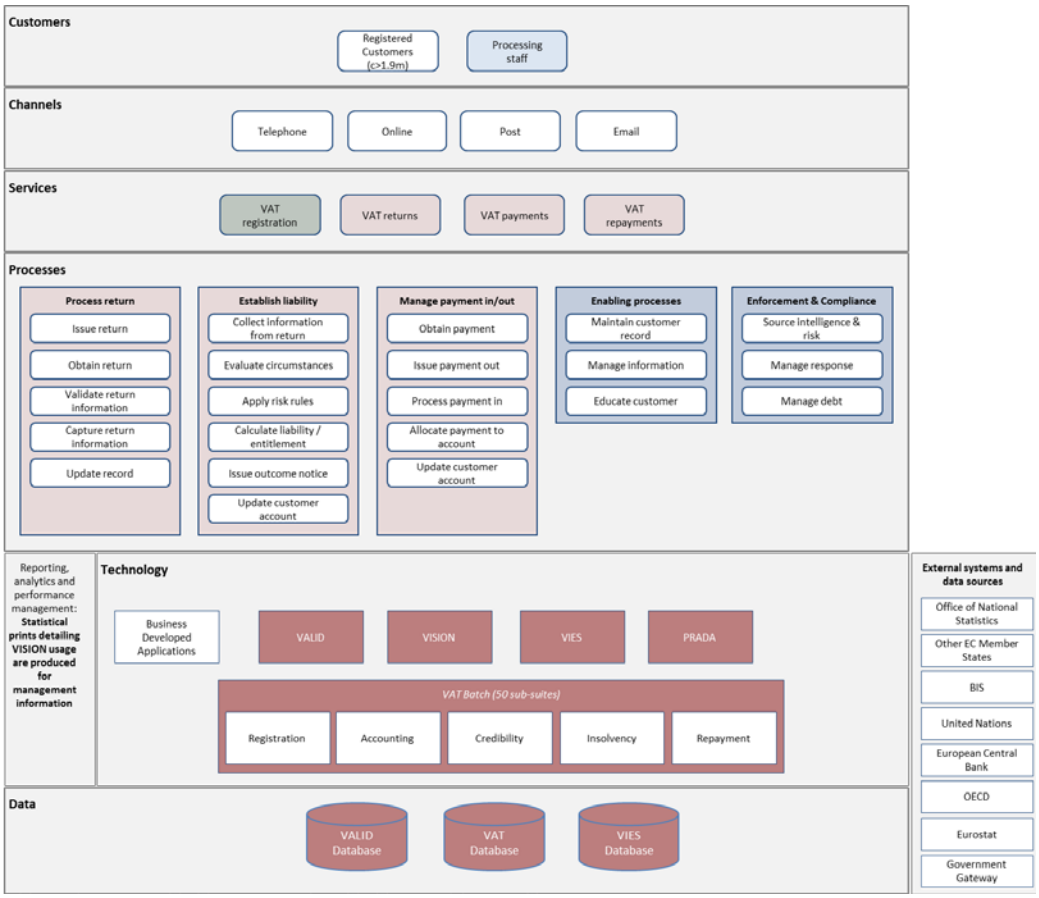
2.5 The VAT ICT systems also provide non-VAT services (Trade Statistics, Duty Deferment, VAT Certificates, Consolidated Tariff System, Departmental Accounting System, Warehousing), but these are beyond the scope of this report.

The Service Model

2.6 Figure 3 shows the components of the HMRC VAT service and defines the scope of our study.

Figure 3

VAT service model



NOTES

1. There are around 50 VAT sub-suites in total, for simplicity only the core daily processing cycle is shown on the diagram.
2. VAT registration is outside the scope of this case study.

Source: National Audit Office analysis

2.7 Customers with an annual turnover above £79,000 are required to register for VAT. In December 2012 there were just over 1.9 million registered customers. The total number of registrations and de-registrations are roughly equivalent which means that over time the customer population remains fairly static (**Figure 4**). The size of the VAT live customer population tends to be affected by economic trading conditions. Hence there has been a steady decline since its peak of just over 2 million customers in 2007-08.

2.8 All customers are required to submit VAT returns either on a monthly, quarterly or annual basis; one month in arrears of the end of the relevant accounting period.

Figure 4

VAT registered customers

The total number of customers remains fairly static over time

	2012-13 (to Dec 2012)	2011-12	2010-11
Customer registrations	158,224	218,663	181,039
Customer de-registrations	158,722	224,030	199.257
Live customer population	1,907,774	1,908,272	1,942,349

Source: UK Trade Statistics, available at https://www.uktradeinfo.com/Statistics/Pages/TaxAndDutybulletins.aspx

2.9 Channels Customers are required to submit VAT returns online and pay VAT electronically. This is provided via the Government Gateway service that enables businesses or their agents to apply for VAT registration and change registration details, and submit VAT returns and set up direct debit instructions. Postal, telephone and email helpline services are also available.

2.10 Services HMRC has identified the core VAT processes as the "VAT common value chain" that includes the registration of customers, the receipt and processing of VAT returns and the processing of payments and repayments (**Figure 5**). Registration of VAT customers includes processes that capture customer registration information and manage the customer record. This is provided by systems and processes outside the VAT ICT systems so is not included in the scope of our investigation. However, it forms an important part of the overall process as the customer information in the VAT database depends on it.

Figure 5

The VAT common value chain

NOTES

1. This does not represent the end-to-end process.
2. Registration is not in the scope of this case study.

Source: National Audit Office of HMRC data

2.11 Processes are directly related to the VAT common value chain (Figure 5):

- **Process return** includes the issue and receipt of the return from the customer and the validation and capture of the information on the return.
- **Establish liability** processes calculate and verify customer liability or entitlement based on the information on the return and the current status of the customer, and issues a notice of the outcome to the customer.
- **Manage payments** in or out receives or issues the payment and allocates it to the correct customer account.
- Register and Reconcile are outside the scope of this report.

2.12 The following processes are not part of the common value chain but form an important part of the overall VAT service and are included within the scope of this report:

- **Enforcement and compliance** includes activities to counter fraud and error. For example, errors in the VAT return will lead to follow-up activity to contact the customer and make the necessary adjustments.
- **Enabling processes** includes activities that maintain the integrity of the data held on the system (manage customer record) to improve the quality of information and provide assistance to customers.

2.13 Technology and data There are a group of ICT systems that deliver the VAT service. These systems are the trigger and repository for VAT return and payment information as well as the provision of credibility data and other data to support the VAT compliance effort. The core components of the VAT ICT systems are:

- The **VAT database** is at the heart of the system. It holds the customer and VAT return information for day-to-day processing. Data relating to customers' accounts, together with data from completed VAT returns, is input to the VAT database where it is stored and used to drive various processing within the VAT system. The main VAT Database uses ICL's IDMSX proprietary database management system.
- **VISION** is the main system used by HMRC staff to access customer information such as customer name and address, customer ledger, and a record of VAT returns all held within the VAT database.
- **VALID** is the main system used by HMRC staff to manually input information into the VAT database such as penalty or payment information.
- **VIES** links the UK VAT ICT systems with those of all EU member states. Data are collected from customers' declared despatches of goods and services to other member states and this information is exchanged with other member states. This is an anti-fraud service that validates customer information and transaction history, and verifies customer liability and entitlement.
- **VATBatch** refers to approximately 50 batch processing sub-suites of COBOL-based programs. The primary daily processing cycle includes:
    - *Registration* - processes customer registrations and sets up a database record for them that includes basic customer details, such as name and address from the registration form. The suite also handles changes to registration information.
    - *Accounting* - maintains accounting records for each customer on the VAT database in respect of customer liability and entitlement, and penalties and surcharges.
    - *Credibility* - checks whether a claim return contains any inconsistencies that may cast doubt on its validity. Any claims identified as such, cause a query slip to be produced, and in certain circumstances cause the repayment to be held pending further review.
    - *Insolvency* - maintains records on the main VAT database for registered customers who have become fully insolvent and records details of the HMRC's claim, as a creditor, against the customer.
    - *Repayments* - determines the customers who are due a repayment of tax and the amount of tax to be repaid.

- **PRADA** is a web-based application that hosts management information and exception reports (known as D-prints, R-prints), and data files, generated by the VAT mainframe, that were historically printed in hard copy. The system was designed to negate the need for printed copies to be produced, allowing staff to export the data into spread sheet format and reducing the amount of unnecessary paper prints.

2.14 The VAT ICT systems connect with many other HMRC systems, but among the key systems are:

- Departmental Trader Register - the primary source of customer information for the VAT ICT systems.
- CECAS GL is a general ledger system that is used across a number of taxes. It records and reconciles VAT receipts and repayments as they are receipted or paid.
- There are several business developed applications that have been implemented to address the limited adaptability of the legacy system. For example, the Return Analysis Tool is a spreadsheet that extracts data from VISION and VIES to enable analysis and comparison to be carried on a number of customers and their transactions. This is used for compliance purposes to match transactions and verify VAT liability.

2.15 The VAT ICT systems also connect with external organisations and systems:

- Trade statistics are provided to the Department for Business, Innovation and Skills, United Nations, European Central Bank, Organisation for Economic Co-operation and Development and the European Commission statistics office (Eurostat).
- European Sales Ledger and customer information among EU member states.
- Registration and return statistics are provided to the Office of National Statistics.
- Government Gateway provides the online access to customer registration and VAT returns.

Part Three

Financial and performance analysis

3.1 In this part of the report, we analyse the recent investments HM Revenue & Customs (HMRC) has made in change capability, the cost of running the VAT service and the performance achieved.

3.2 For this review, we asked HMRC to provide us with service and ICT system performance data for 2010-11 and 2011-12. We also requested cost data for the VAT service for the period 2008-09 to 2013-14, and all cost data relating to the legacy VAT ICT systems held by HMRC. HMRC was still providing us with data in the very late stages of finalising this report and several months after it had originally been requested. For financial data, the late provision of data has prevented us from verifying costs and forming clear conclusions. For performance information, we saw indications that HMRC has a good set of data that it uses in its day to day management. However, we were unable to fully confirm this finding or obtain sufficient data to allow us to conclude on the performance of the VAT service. The challenges we faced in obtaining data from HMRC suggest that it may face challenges in robustly planning for the longer term.

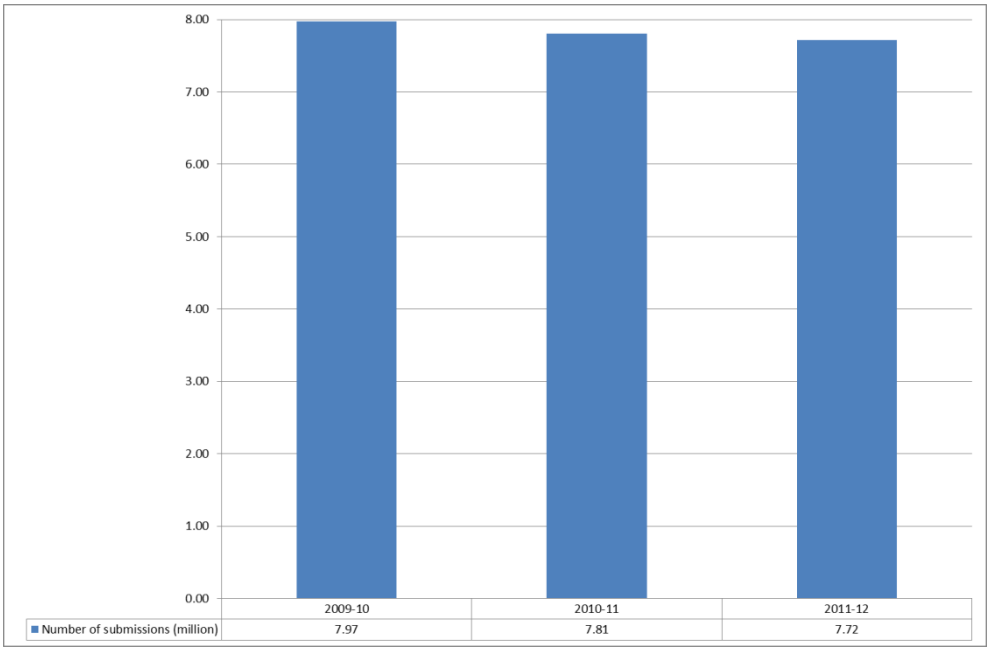
Service and system performance

3.3 The key volume measure for the VAT collection service is the number of VAT submissions made by customers to HMRC. These fell by 2 per cent per annum between 2009-10 and 2011-12 (**Figure 6**). This was partially caused by a reduction in the number of customers and partially by a reduction in the number of submissions per registered customer, for example through greater use of annual rather than quarterly VAT returns.

Figure 6

Number of submissions, 2009-10 to 2011-12

Submissions fell by 2 per cent per annum between 2009-10 and 2011-12



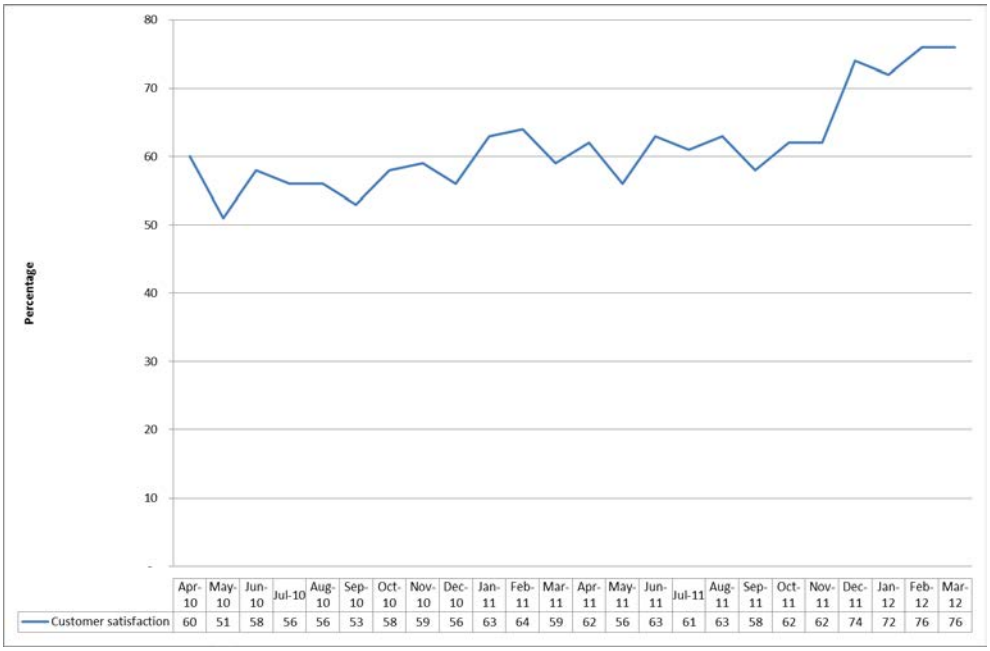
Source: HMRC

3.4 Customer satisfaction with the VAT collection service improved between 2010-11 and 2011-12. In 2010-11 an average of 58 per cent of customers were satisfied with the service. For 2011-12 this rose to 65 per cent and was above 70 per cent for the last four months of 2011-12 (**Figure 7**). This improvement appears to be linked to improvements in the online VAT service.

Figure 7

Customer satisfaction with the VAT collection service

Customer satisfaction with the VAT collection service improved between 2010-11 and 2011-12



	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12
Customer satisfaction	60	51	58	56	56	53	58	59	56	63	64	59	62	56	63	61	63	58	62	62	74	72	76	76

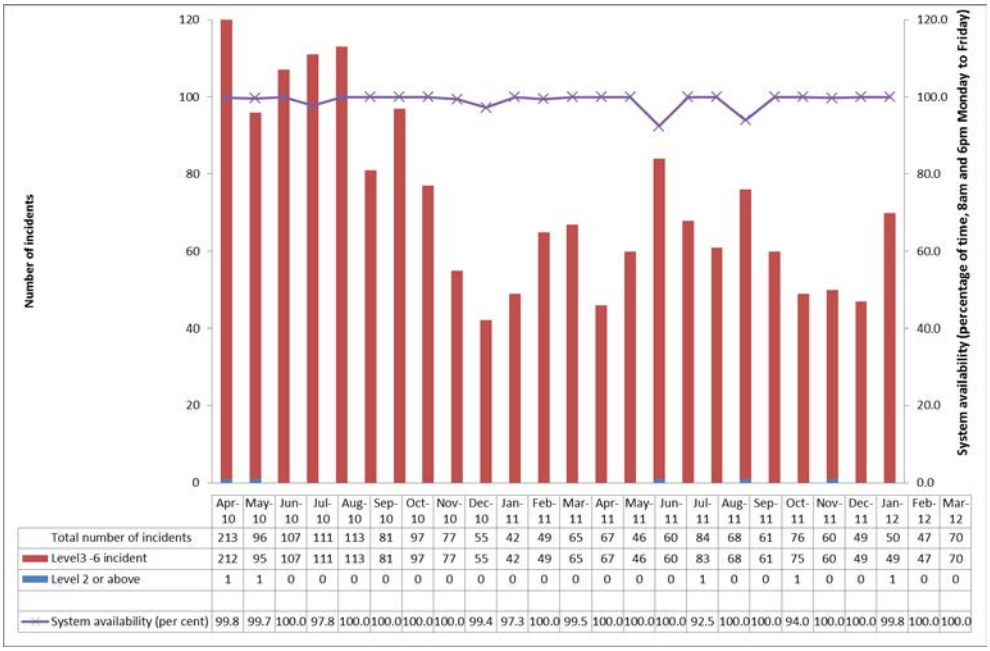
Source: HMRC

3.5 We found that the VAT ICT systems are stable and reliable. HMRC achieved 100 per cent availability in four of the last five months of 2011-12 and 99.8 per cent in the other month, January 2012. There were three major incidents affecting the VAT ICT systems in 2011-12 and two in 2010-11. April 2010 saw a high level of minor incidents, primarily as a result of a problem with one of the applications. HMRC classed this as a major incident once it had linked a large number of minor incidents raised about the problem. Between May 2010 and March 2011 there was an average of 81 minor incidents a month. This average fell to 61 incidents per month for 2011-12. (**Figure 8**)

Figure 8

Performance of the VAT ICT systems, availability and number of incidents

The VAT ICT systems are stable and reliable



	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12
Total number of incidents	213	96	107	111	113	81	97	77	55	42	49	65	67	46	60	84	68	61	76	60	49	50	47	70
Level3 -6 incident	212	95	107	111	113	81	97	77	55	42	49	65	67	46	60	83	68	61	75	60	49	49	47	70
Level 2 or above	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0
System availability (per cent)	99.8	99.7	100.0	97.8	100.0	100.0	100.0	100.0	99.4	97.3	100.0	99.5	100.0	100.0	100.0	92.5	100.0	100.0	94.0	100.0	100.0	99.8	100.0	100.0

NOTES

1. A level 2 or above incident is defined as one that results in more than 10 per cent of users being unable to access the service or a failure of overnight processing or an inability to produce printed output for the public.
2. There are four in-scope VAT systems for which availability data are available and the number reported above is the lowest availability on these four systems. System availability is measured as the percentage of business hours, typically 8am to 6pm Monday to Friday, for which service is available.

Source: HMRC

Financial performance

3.6 The financial data provided to us by HMRC was insufficient for us to undertake a full analysis of financial performance. Much of what was provided also came too late for us verify its consistency with our evaluation framework and underlying departmental records. The data we have shows the following:

- The full cost of the service, including processing activity, compliance activity, ICT costs and overheads was £429.6 million in 2011-12. This excludes VAT registration activities as they are supported by different ICT systems.
- The £429.6 million was £27 million (7 per cent) more than was spent in 2010-11, after adjusting for inflation.
- Of the £429.6 million:
    - £242.1 million relates to direct staff in the VAT business engaged in processing or compliance activities;
    - £13.4 million relates to the VAT common value chain described in Figure 5;
    - £61.7 million relates to the cost of all ICT used in providing the VAT service; and
    - £4.5 million relates to the running cost, people and infrastructure, for the VAT mainframe system.

Part Four

Our enterprise analysis of HMRC's VAT service

4.1 In this part, we summarise the findings of our enterprise analysis. Each section highlights a key finding and the scores we have allocated HM Revenue & Customs (HMRC) as part of our assessment. Our scoring runs within the range of 1 to 5, the higher the number the better the performance. Two sets of scores are applied which represent where the organisation is currently and where we believe its performance will be in 12 to 18 months, based on the evidence we have found and what is achievable in a financially constrained department. The enterprise analysis framework can be found in Appendix Three**.**

Strategy and business model

	Our assessment	
Key finding	**Now**	**Future**
HMRC have an overarching strategy. However, we found that practical plans and proposals to transfer VAT over to ETMP have not yet been formally considered and constraints lie in a non-strategic approach to funding.	3	3

4.2 The HMRC ICT strategy aims to reduce costs, reduce the complexity of IT estate, increase systems performance and build platforms for the future. One initiative is the '13 Machines' strategy which intends to rationalise and streamline HMRC's ICT estate, reducing the number of HMRC IT applications from 600 to approximately 150, sitting on just 13 ICT platforms.

4.3 The constraints of legacy systems are recognised in the 13 machines strategy. HMRC acknowledges the challenge of the complex landscape and the fact it is constrained by an IT capability formed around batch legacy systems originally designed to handle paper that still process forms in overnight batches.[8]

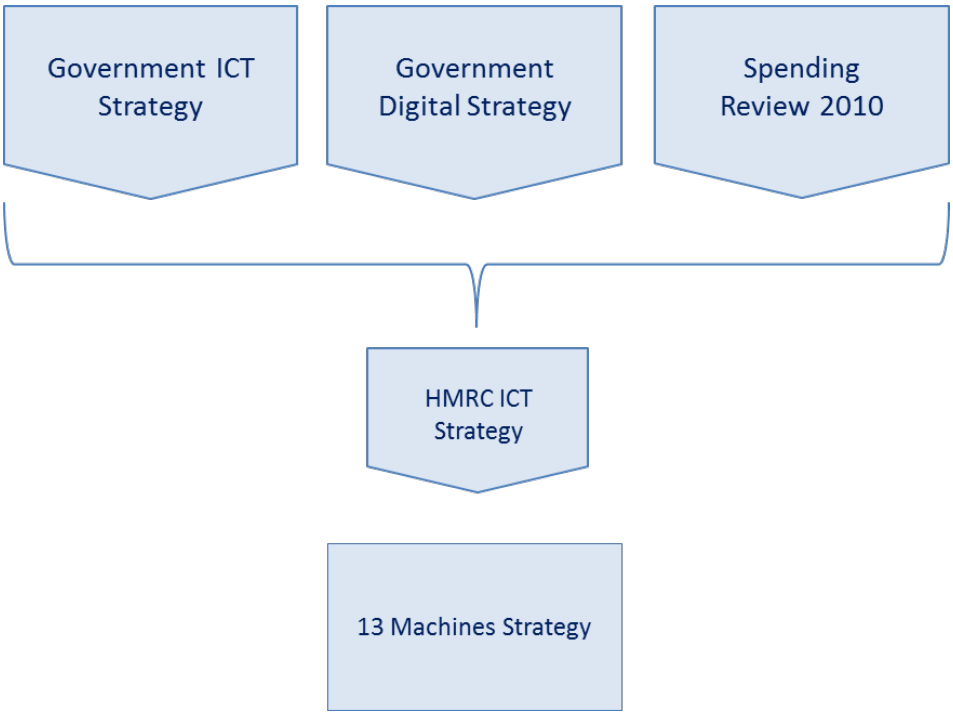
4.4 The strategic background to HMRC business tax and VAT ICT systems is illustrated in **Figure 9**.

[8]HMRC *'The 13 Machines and the Enterprise Tax Management Platform* ,Version 1, 4 December 2012

Figure 9

Strategic background to HMRC VAT ICT systems

The '13 Machines' strategy and the Enterprise Tax Management Platform



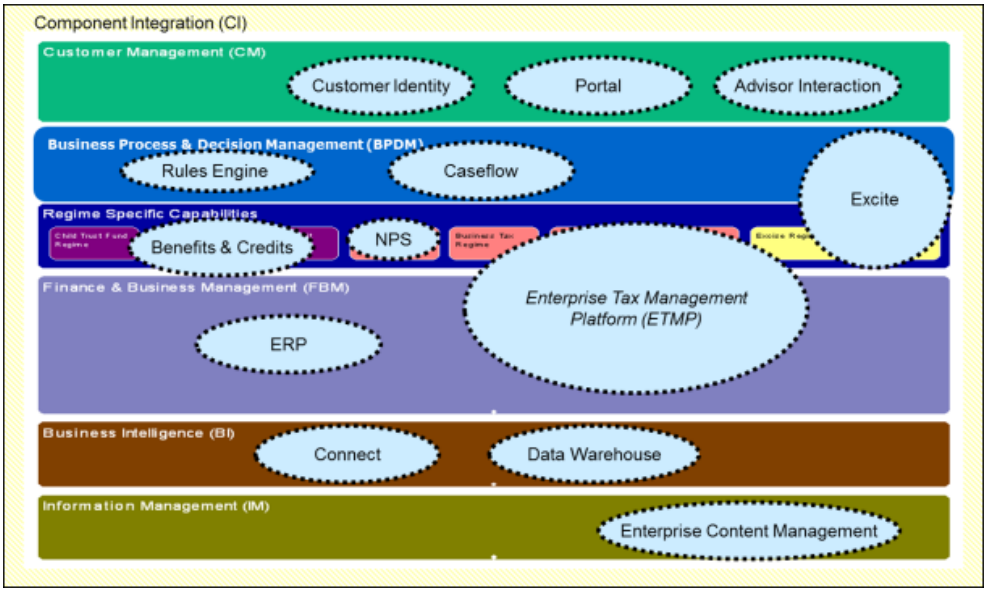
Source: National Audit Office analysis

4.5 One of the '13 machines' is the Enterprise Tax Management Platform (ETMP) which aims to move business tax systems onto a single strategic SAP platform (**Figure 10**). VAT registration will be the first part of the service to be moved as part of a separate VAT Registration Transformation programme. However, while there is a widely accepted vision to move the remainder of the VAT service to ETMP we found no immediate business case or implementation proposals in place.

Figure 10

HMRC '13 Machines' Strategy

Building platforms for the future



Source: HMRC

4.6 Alongside this, there are service reviews and business process re-engineering projects underway. However, we found that current efforts are mostly limited to tactical solutions or small changes.

4.7 Investment funding continues to be a key constraint. Redevelopment of the VAT ICT systems has been considered in the past but costs were considered to be prohibitive and the initiative did not progress. HMRC state that projects are only allowed to proceed if they are regulatory or increase yield. As a result it is highly possible that future constrained investment in HMRC will continue to limit improvements to tactical changes rather than address the more strategic and more deeply embedded problems of a service dependent on the legacy estate.

Governance, architecture and standards

	Our assessment	
Key finding	**Now**	**Future**
HMRC has comprehensive governance, architecture and assurance arrangements for the existing service.	4	4

4.8 HMRC governance arrangements provide effective oversight and direction on the ICT portfolio and the lifecycle of changes.

4.9 HMRC has adopted an enterprise architecture approach to improve alignment of IT and business services. Prior to this initiative HMRC had more than 600 systems in the period up to 2009 which were historically developed in isolation. To prevent further fragmentation, changes have been made to governance arrangements to align new initiatives to the strategy. This is known as “Technology Refresh” and includes the involvement of ICT architects at the very early stages of new initiatives to shape the projects, to ensure re-use of existing ICT assets and maintain consistency with existing standards.

4.10 The business and the IT group meet regularly to discuss service issues, enhancements and risks. Risk management processes for the day-to-day VAT service are comprehensive. Business risks are documented and legacy system and data assurance risks are identified and regularly reviewed, documented and managed at a sufficiently senior level, with mitigating actions agreed and assigned.

4.11 There were clear and consistent strategies for data standards and architecture ensuring continual improvements of the quality of the arrangements provided by the legacy system. Data are provided to other systems so quality monitoring is a key focus and data quality is good with 99.99 per cent accuracy against quality standards being achieved. The sources of data are well understood and business users have trust in the information.

Implementation

	Our assessment	
Key finding	**Now**	**Future**
Modifications are limited to tactical changes that are delivered in a structured and controlled manner.	3	3

4.12 Changes are delivered in a structured and controlled manner. Testing and release management are all well executed and documented in partnership with the business, and a test and development environment is available and used by an independent test team and regularly audited. Timetables for releases can be based on legislative/EU timetables but VAT releases are generally flexible and do not impact on business service.

4.13 Modifications are limited to tactical changes that are delivered around individual services rather than an organisation-wide perspective. This tactical approach is characteristic of an organisation running non-integrated legacy systems but this means that it is more challenging for HMRC to deliver corporate strategic change, such as the ETMP.

4.14 HMRC has done well to continually update the VAT ICT systems to support the change in the way VAT return and payment information enters the system. In the past, VAT return information was entered manually by operators. These were replaced by the electronic scanning of paper VAT returns and the current online service. HMRC has avoided the capital expenditure needed to fully replace the system and the risk of disrupting service performance that such a large change would entail.

4.15 The successful implementation and benefit realisation of the '13 Machines' strategy depends heavily on business readiness to adapt and adopt new ways of working. There was some evidence of this thinking in the Business Process Re-engineering work but we did not find any references to changes to business culture and working practices, which is also required to get maximum benefits.

Service management

	Our assessment	
Key finding	**Now**	**Future**
The VAT ICT systems are stable and meet current business needs.	4	4

4.16 At the time of our audit statistics showed that the VAT ICT systems are stable and reliable, achieving 100 per cent availability in four of the last five months of 2011-12, and 99.8 per cent in the other month, January 2012.

4.17 A multi-user forum exists for business-as-usual performance management discussions. There are formal and mature service management processes in place and there are business/Service Level Agreements (SLAs) in place between the various directorates and ICT. These are typically supplemented by operational SLAs which are updated regularly; the performance of systems is covered separately for the applications and infrastructure. The Business SLA is reviewed and updated annually.

4.18 Customer feedback on the service is positive. Customer satisfaction with the VAT collection service improved between 2010-11 and 2011-12. In 2010-11 an average of 58 per cent of customers were satisfied with the service. For 2011-12 this rose to 65 per cent and was above 70 per cent for the last four months of 2011-12.

4.19 HMRC has an in-house team who manage and support the VAT application while the hardware environment is provided through Aspire, HMRC's ICT supply contract with Capgemini and Fujitsu. Due to the scale, age and complexity of the VAT ICT systems only a small number of large ICT suppliers are able to support it. This will be an important consideration when the current contract comes up for renewal in 2017. Fujitsu also supports Virtual Machine Environment (VME) and will continue to do so until 2020. This end date for support for the current VME operating system product was announced in 2007. All government departments with VME systems will have to choose to either migrate their legacy VME applications or to continue to run them using the new cloud based service planned by Fujitsu.

People

	Our assessment	
Key finding	**Now**	**Future**
The support team is very experienced and holds vast knowledge of the VAT ICT systems. Whilst good consideration is given to succession planning, the deep knowledge of the workings of the system will be difficult to replace.	3	3

4.20 HMRC has a very experienced and knowledgeable internal ICT team to support its systems. The team profile is ageing; the youngest member of staff is in their 40s and some staff members are nearing retirement age. It will become increasingly difficult to source technical skills in VME and COBOL and develop the requisite expertise in the unique complexities and characteristics of the VAT ICT systems and service. HMRC acknowledges the future risks and has taken early and reasonable steps to identify skill gaps and single points of failure. It is developing a workforce succession plan and is also recruiting new staff to the team. These are key undertakings but in the longer term the impact of attrition may not be sustainable due to the deep rooted system knowledge of the current team.

4.21 During our visit to Liverpool we observed that the business casework, compliance and other business checking was carried out by staff who were highly knowledgeable with deep experience. However, we did not see any evidence of business succession planning.

Process

	Our assessment	
Key finding	**Now**	**Future**
Additional processes are required due to the limited adaptability of systems using batch processing.	3	3

4.22 The VAT ICT systems operate in "batch" mode that reflects the data entry limitations of 1970s business computing, which means that data updates are carried out in batches, usually overnight. Therefore they were not designed to support real-time transactions and cannot effectively do so. The VAT process, which HMRC refer to as the common value chain (Figure 5), consists of business processes which has been developed over time. This covers registration, return processing, establishing liability, making payments and reconciliation. Within these processes we found there are exceptions, designed by HMRC to manually intervene in the normal straight-through processing where for instance a manual risk assessment is required prior to the acceptance of work item. An HMRC commissioned Business Process Re-engineering exercise found that *"20% of cost goes through the Exception Handling Processes, many of which have been created for stand alone reasons or due to high system change costs."* [9]

4.23 Additional processes are required due to the limited adaptability of systems using batch processing. The VAT Return error correction process is a typical example of such manual intervention. VAT returns submitted online are only partially validated and corrected as they are entered. Full validation, risk identification and correction can only be done after the overnight batch is run. At that stage errors are picked up by the error correction team and addressed manually. This is typical functionality for the technology design of that era. Validating, and identifying more errors, at the point of submission would lead to greater efficiencies.

4.24 The VAT Directorate developed the Return Analysis Tool (RAT) to enable it to analyse and match customer transaction information. It carries out an extraction of data from VISION and VIES to a spreadsheet in a matter of minutes, if this was undertaken using the VAT ICT system, it would take far longer. RAT has delivered considerable efficiencies and overcomes the limitations of the legacy system.

[9] HMRC *VAT Business Process Re-engineering Final Report Version 1.0,* 31 January 2012

4.25 The VAT ICT systems are compliant with security standards and have been independently assessed and certified in line with government accreditation requirements. Access to the system is also well managed and controlled through the granting of appropriate user access rights (with a User ID and password) which are monitored and audited in a formal manner. Backup and recovery capability of the legacy system is regularly reviewed and tested.

Technology

	Our assessment	
Key finding	**Now**	**Future**
The technology is highly stable and has few performance issues. As a result there are no real drivers for change purely from a technology viewpoint.	3	3

4.26 While HMRC's VME system dates back to the 1970s, the hardware, operating system and VME software have been kept up to date and were last refreshed in 2010-11 onto a modern hardware and software platform.

4.27 The application is programmed primarily using the COBOL programming language which dates back to the 1960s. HMRC has told us that one of the programs consists of about 250,000 lines of code and is reputed to be one of the largest in the world.

4.28 The VAT ICT system component known as VATBatch actually refers to approximately 50 batch processing sub-suites of programs (2,100 programs). These applications have had 30 years of development and some have become highly complex, causing problems when change is required or when new staff are introduced to the system for succession planning purposes.

4.29 The design of the database and storage structures was put in place during implementation in the 1970s. There was a major redesign in 1990, and minor restructures since then. Many of the lines of code that support this would be redundant in any modern system. This complexity causes an overhead on making changes and testing of the system. Other features of the original design include control accounts and error checking which add complexity, where modern accounting systems include these features as standard. This is another area which would be redundant in a new system.

4.30 HMRC have successfully integrated the VAT ICT systems to transmit data effectively between systems developed in different technologies.

4.31 There is some uncertainty regarding the VME support arrangements after 2020, when organisations may be required to purchase the product as a managed service.

Part Five

The lessons learned from the impact of legacy ICT on HMRC's VAT service

5.1 In this final part of the report, we use the results from our service, financial and enterprise analysis to draw out the key lessons learned from the impact of legacy ICT on VAT services.

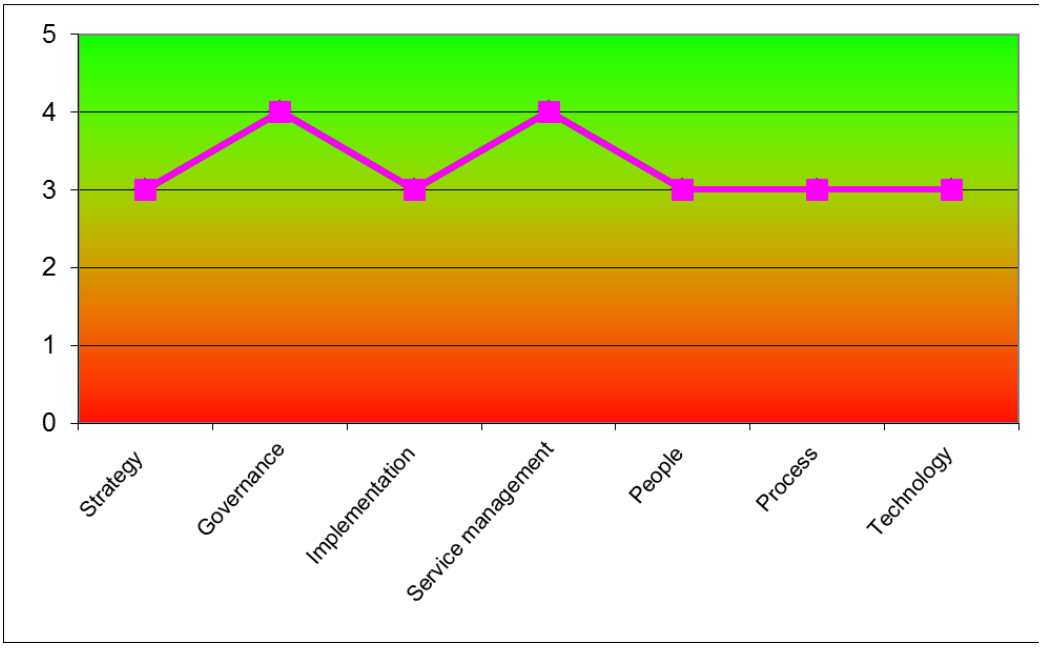
5.2 This case study provides an example of how legacy systems can perform well and provide the basis for an efficient service for many years with well-maintained technology and knowledgeable staff, and when the underlying technology is stable the need for a legacy strategy is not considered a priority.

5.3 From our enterprise analysis and the scoring assessment (**Figure 11**), we believe that performance is unlikely to change in the next 12 to 18 months but this would not be sustainable in the longer term.

5.4 In **Figure 12**, we outline the key lessons from the VAT service.

Figure 11

Enterprise analysis summary assessment



NOTE

1. We found that performance is unlikely to change in the next 12 to 18 months so assessment scores for current and future performance are identical.

Source: National Audit Office analysis based on the enterprise analysis framework (Appendix Three)

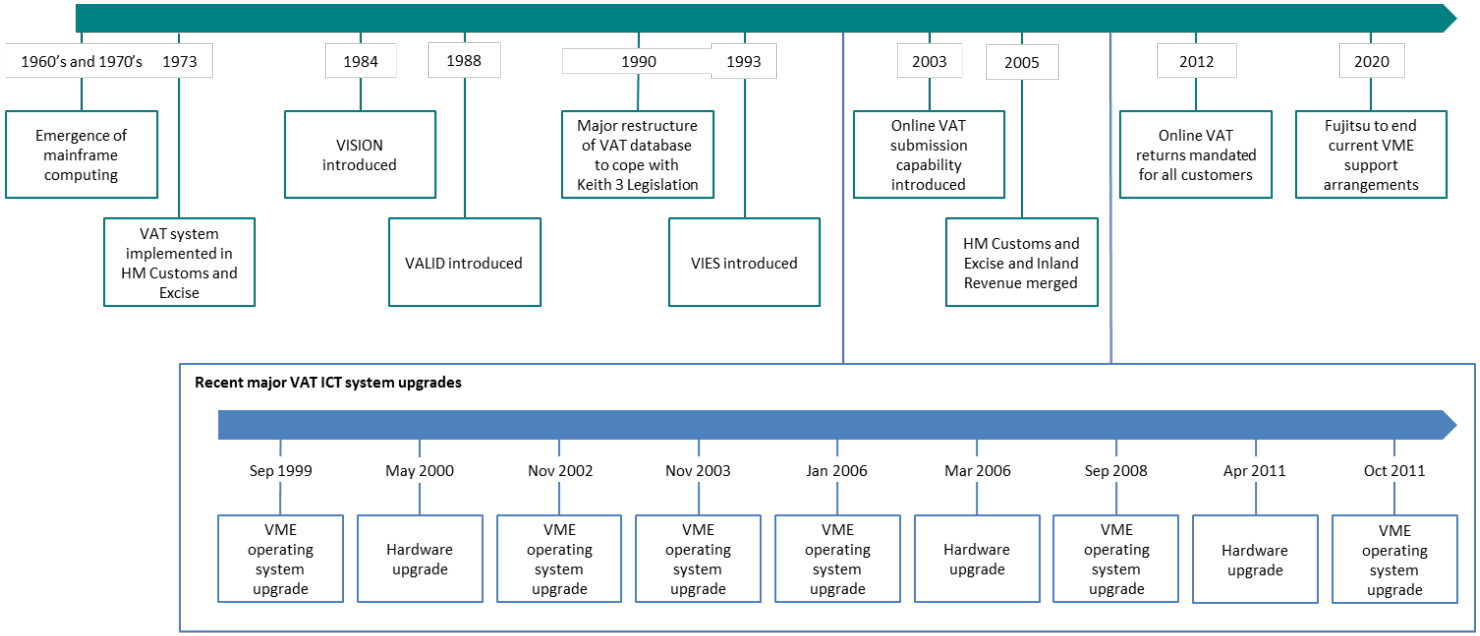
Figure 12

Lessons from the VAT service

Lessons	Commentary
Legacy systems can perform well and provide the basis for an efficient service for many years.	HMRC VAT ICT systems are an example of a number of good legacy systems that have performed well for a number of years with well-maintained technology and experienced staff. Other departments could learn lessons from them on how to efficiently run legacy systems.
When the underlying technology of legacy systems is stable, the need for a legacy strategy is not considered a priority.	HMRC has not produced a legacy strategy for VAT although it is aware that a batch legacy system is a constraint on the HMRC strategy to provide customer centric digital services. The on-going robustness of the VAT ICT systems militates against thinking or action around long term planning.
Without information on the total cost of ownership of the service, business decisions on the impact of legacy systems are severely hampered.	HMRC has built technology workarounds and business process workarounds to support new VAT requirements over many years. The cost of this additional functionality is not understood, so the full cost of running the service is not known. It is therefore not possible to know if the costs of running the service based on the VAT ICT systems are rising. If they were this might be a major driver for a business case for change.
An ageing workforce and scarce legacy system knowledge and skills, mean that succession planning must be seriously considered and action taken.	HMRC has acknowledged the future risks of an ageing workforce on its ability to support the legacy systems and has taken steps to identify skills gaps and single points of failure and are developing their succession planning. Other government departments can learn from this. However, this is not sustainable and a risk remains due to the loss of working knowledge of the system which cannot be replaced.
Business operational priorities and lack of funding act as a constraint to a more strategic approach to managing a legacy based service.	The HMRC ICT team has produced a long-term vision and strategy which includes legacy transformation but the business strategy, governance, funding regime and process re-engineering work does not prioritise or consider moving the VAT service off the legacy VAT ICT systems.
Legacy ICT may be unable to support digital transformation of a service.	HMRC has enhanced its VAT service by adding online VAT registration functionality. However true digital transformation cannot take place until real-time transaction and true end-to-end process redesign takes place.

Appendix One

Timeline



VISION - the main system used by HMRC staff to access customer information.
VALID – the main system used by HMRC staff to manually input information onto the VAT database
VIES – links UK VAT systems with those of all EU member states.

Appendix Two

Methodology

This section describes the methodology we used for our fieldwork, which centred on the application of our business analysis toolkit. This consists of three elements: financial and quantitative analysis, analysis of the service model and application of our enterprise analysis framework. (A full description of our enterprise analysis framework can be found in Appendix Three). The study team was composed of NAO staff.

Method

Financial and quantitative analyses including:

- Interviews with financial and operational staff
- Analysis of investment and spend data
- Analysis of service performance and service reporting data

Analysis of service model including:

- Semi-structured interviews with service and contract management staff, technical stakeholders and representatives from suppliers
- Document review of ICT and contracting strategies, reviews of the ICT estate, technical descriptions and publicly available service information

Application of our enterprise analysis framework including:

- A workshop of key stakeholders where they self-assessed and scored themselves against the components of the framework
- Semi-structured interviews with corporate service leaders, senior technical staff, system users drawn from HMRC staff and representatives from the suppliers
- Data and document review that encompassed key contracts, technical and design documentation, management information, minutes from service and risk forums, risk registers and service impacting incidents
- A 'wash up' workshop where the results of National Audit Office fieldwork findings were played back to senior stakeholders and compared with self-assessment

Appendix Three

Enterprise analysis framework

Good practice in the management of legacy ICT

Strategy and business model	**Strategy and business model** There is a clear strategy in place for the service, which the organisation regularly reviews and updates to reflect changes in its business environment and/or exploit new technologies.
	Business case and funding Business case(s) for replacement reflect good practice (e.g. *HM Treasury Green Book*), are regularly reviewed and challenged, and opportunities are exploited and managed.
	On-going costs Costs of the services are fully understood and managed against a budget and prioritised business demands. Costs are challenged and optimised, and the value of asset/investments is fully exploited.
Governance, architecture and standards	**Technical governance** Technical governance arrangements provide strong and effective oversight and direction on the ICT portfolio and the lifecycle of the legacy system. Regular meetings take place between business and IT to identify and prioritise changes in business requirements and legacy ICT capabilities, risks and issues, opportunities and threats.
	Enterprise architecture There are clear links and strong alignment between the IT strategy and business strategy, and the legacy system is supported by a documented comprehensive technical architecture.
	Data quality and assurance A clear and consistent strategy for data standards and architecture ensures a coordinated approach to continually improve the quality of information provided by the legacy system. The sources of data are well understood and business users have trust in the information.
	Risk management Risk management processes ensure that the business risk appetite is documented and legacy ICT and information assurance related risks are identified and regularly reviewed, documented and managed at a sufficiently senior level, with mitigating arrangements agreed. Key stakeholders have clear visibility of the level of risk exposure.

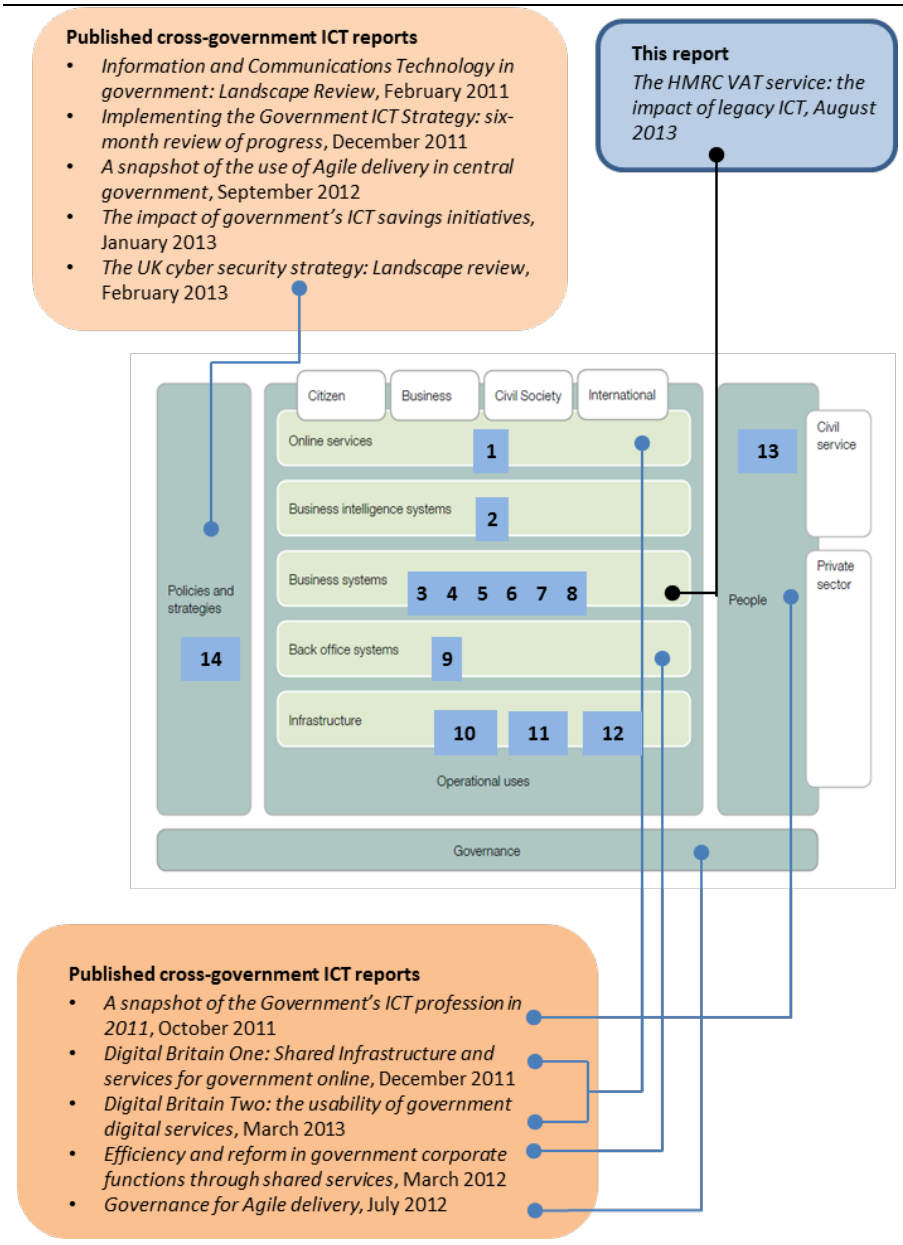
Implementation	**Lifecycle management** The system is readily adaptable to changing business needs and evidence of structured development and enhancement throughout its life can be seen. Testing plans and procedures are designed in partnership with business, release management processes are in place and system documentation is current, maintained and available. Software media and licence codes are available and regularly confirmed as operational.
	Decommissioning legacy All legacy systems have been identified and effective transition arrangements, accountabilities and responsibilities have been agreed. All legacy data have been identified, cleansed and mapped to the new solution and decommissioning costs have been identified.
	Retaining legacy There is a legacy systems strategy in place that identifies what the business defines as legacy, the contract lifetimes and the anticipated technology lifetime of each architecture component, service and application, and the factors to be considered in making retirement/retain decisions.
Service management	**Service performance** There is clear definition of the service that is continually reviewed and improved in partnership with the end-users and/or customers, and service delivery performance is regularly compared with target performance and good practice benchmarks. The dependency of the legacy system on service performance is known, with risks and issues managed effectively.
	Management of supplier services Outsourced services are actively managed and regularly market tested to ensure value for money, the relationship is collaborative and information about future changes to the legacy system or the service are discussed between both parties.
	Change management An agreed multi-user forum exists for engaging in high-level strategy, performance management and service evolution discussions, which inputs to management decisions about future direction and investment. There is a tailored organisation wide training programme with clear success criteria being monitored.
People	**Internal workforce** The staff responsible for the on-going operation of the legacy system have the necessary skills and undertake training to perform their role. Training covers awareness of developments in the market and relevant associated technologies. Recruitment, retention and development activities are aligned with the needs of the service and its customers. Succession plans are in place for all key roles.
	Supplier capability Reliance on service providers and contractors involved in the on-going operation of the legacy system is known and actively managed. There are regular reviews of the ability of service providers to continue to support the legacy system throughout its projected lifetime, and there are agreed solution roadmaps are in place.

Process	**Business processes** Development or improvement of business processes is not hindered by the capabilities of the legacy system, and/or new processes required by the business are assessed against the capabilities of the legacy system and failure to meet new requirements triggers a system review.
	Technical processes Data management processes are in place and owned by the business and are applied to the legacy system. Backup and recovery capability of the legacy system is regularly reviewed and tested, and adherence to agreed recovery objectives is actively measured. Access management controls are implemented and monitored with exception event procedures in place.
	Security processes The legacy ICT system meets government security standards (accreditation) in a cost-effective manner and its security controls ensure the confidentiality, availability and integrity of data. External security risk assessments are carried out regularly. No bespoke security systems or processes are required.
Technology	**Applications** The legacy ICT system fully integrates with the wider ICT environment using standard protocols or common application programme interfaces. Software versions are current and fully supported with plans in place for future upgrade.
	Performance. The availability and performance of the legacy system is captured as part of service performance measurement.
	Infrastructure The solution is sufficiently scalable to allow the addition or removal of components to meet service demand or enhanced to meet changing business needs. A regular patch cycle schedule is in place to apply functional and security patches systematically. Test facilities exist that replicate the production environment exist or can easily be created and removed as required.

Source: National Audit Office enterprise analysis toolkit

Appendix Four

Published reports focusing on ICT



NOTE

1.For published client reports focused on ICT see next page

Source: National Audit Office

Published client reports, focused on ICT

Online services

1 HM Revenue & Customs: *The expansion of online filing of tax returns*, November 2011.

Business Intelligence systems

2 Ministry of Defence: *The use of information to manage the logistics supply chain*, March 2011.

Business systems

3 Department of Health: *The National Programme for IT in the NHS: an update on the delivery of detailed care records systems,* May 2011.

4 Department for Communities and Local Government: *The failure of the FiREControl project,* July 2011.

5 The Crown Prosecution Service: *The introduction of the streamlined process*, November 2011.

6 Department for Work and Pensions: *The introduction of the Work Programme*, January 2012.

7 Department for Work and Pensions: *Child Maintenance and Enforcement Commission: cost reduction,* February 2012.

8 HM Revenue & Customs: *The Compliance and Enforcement Programme*, March 2012.

Back-office systems

9 Department for Business, Innovation and Skills: *Shared services in the Research Councils,* October 2011.

Infrastructure

10 Department for Environment, *Food and Rural Affairs: Geographic information strategy*, July 2011.

11 Home Office and National Policing Improving Agency: *Mobile technology in policing*, January 2012.

12 Department for Culture, Media and Sport: *The rural broadband programme,* July 2013

People delivering and operating government ICT

13 Department for Business, Innovation and Skills and Skills Funding Agency: *Adult apprenticeships*, February 2012.

Policies and strategies for information and technology and business

14 Department for Environment, Food and Rural Affairs and the Animal Health and Veterinary Laboratories Agency: *Improving the delivery of animal health and welfare services through the Business Reform Programme*, July 2012.

National Audit Office

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