UNIVERSITY OF BIRMINGHAM

Oracle APEX RAD Tool Evaluation

1 Purpose

RAD (Rapid Application Development) is a concept of software development that focuses on speed, prototyping & iterative development rather than a formalised, time-consuming methodology. The idea behind RAD is to deliver solutions which are more efficient & meet the user requirements in a more dynamic & accurate way. Working with delivery of prototypes & iterative releases also allows developers to create solutions rapidly.
RAD tools can be very useful for creating potential solutions very quickly and save huge amounts of development time. Small to medium sized development projects with minimal complexity are a good fit for RAD development and many RAD tools now use a simplistic, visual development environment to help make it easy to develop solutions for even non-technical developers. However, RAD tools can be very expensive and, even though many RAD tools are designed with simple, visual drag-and-drop development environments, they still can entail a learning curve, which can be time consuming and complex.

The need for a rapid application development tool within the University of Birmingham (UoB) is an essential one. There are many small to medium sized web development projects which are either ignored completely due to the small project scope/size, given low priority (and so are delayed), or take a relatively long time to develop due to the development methods & tools used.

For this evaluation, the Oracle APEX development tool will be reviewed to determine how well it works as a RAD tool for web applications development and possible impact it could have on small to medium sized application development projects within the organisation.

2 The Oracle APEX Tool

2.1 Oracle APEX

Oracle Application Express (Oracle APEX), formerly called HTML DB, is a rapid web application development tool for the Oracle database. Using only a web browser and limited programming experience, you can develop and deploy professional applications that are both fast and secure. Oracle application express combines the qualities of a personal database (i.e. productivity, ease of use, flexibility) with the qualities of an enterprise database (security, integrity, scalability, availability and built for the web). Application Express is a tool to build web-based applications and the application development environment is web-based.

Figure 1 - APEX Home Page

The APEX tool is provided *free* with the Oracle Database product.

No client software is required to develop, deploy, or run Application Express applications. Application Express provides three primary tools:

- Application Builder - to create dynamic database driven web applications
- SQL Workshop - to browse your database objects, run ad-hoc SQL queries, as well as a graphical query builder
- Utilities - allows for data to be loaded and unloaded from both flat files and spreadsheets

2.1.1 What types of applications can you build with Application Express?

Application Express is a productive tool to build applications that report on database data. Reports are typically hypertext linked with other reports allowing users to navigate through database data in the same way they navigate web sites. Columns in reports can be easily linked to other reports, charts, and data entry forms and it is all done declaratively. An extensive charting engine allows SQL queries to be represented graphically and that allows data to be more effectively communicated. Application Express is also very adept at editing database data and supports a large number of declarative form controls including radio groups, checkboxes, select lists, shuttles, text editors, and date pickers.

2.1.2 When to use Application Express?

Due to its ease of use, Application Express is designed to build opportunistic and departmental applications quickly. These applications are deployed on the web with superior performance. Historically, departments, prototypes, and small projects have relied on desktop databases to provide an agile development tool for these smaller scale SMB or departmental application development needs. Desktop databases can become very fragmented because they keep data in too many places, they can be vulnerable or inappropriate for use with sensitive information, and they are typically not web friendly. The browser based design time interface, the declarative programming framework, and simple wizards make Application Express a natural replacement for multi-user desktop databases applications such as Microsoft Access.

Application developers who have SQL knowledge also appreciate the ease with which you can create database applications with little or no web experience. You do not need to learn scripting languages or complex deployment frameworks, you simply write a few queries and choose from ready built user interface themes and form controls to create highly professional, secure, and scalable applications

Further details regarding the APEX Tool can be found here:
http://www.oracle.com/technetwork/testcontent/what-is-apex-099128.html#close

2.2 APEX Application Builder

The Application Builder is the tool you use to build the pages that comprise an application. You can create web pages, data forms, reports, charts & interactive grids. All these can be created manually or through a simple automated wizard process. The navigation & application menu layout is also defined here.

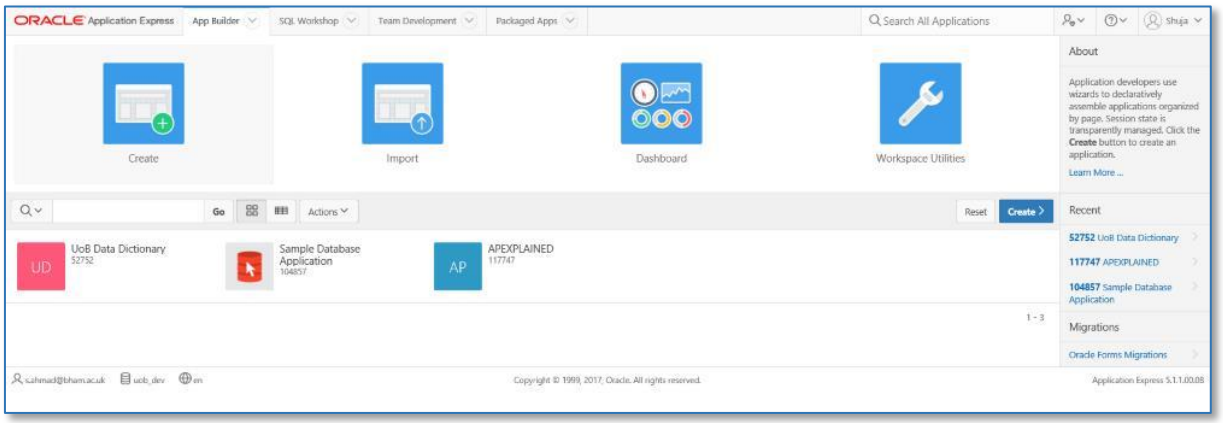

Figure 2 - Application Builder Home Page

There are several options for the types of applications you can create; the two key ones are 'Desktop' and 'Mobile'. The 'Mobile' app will be customised to work with mobile devices.

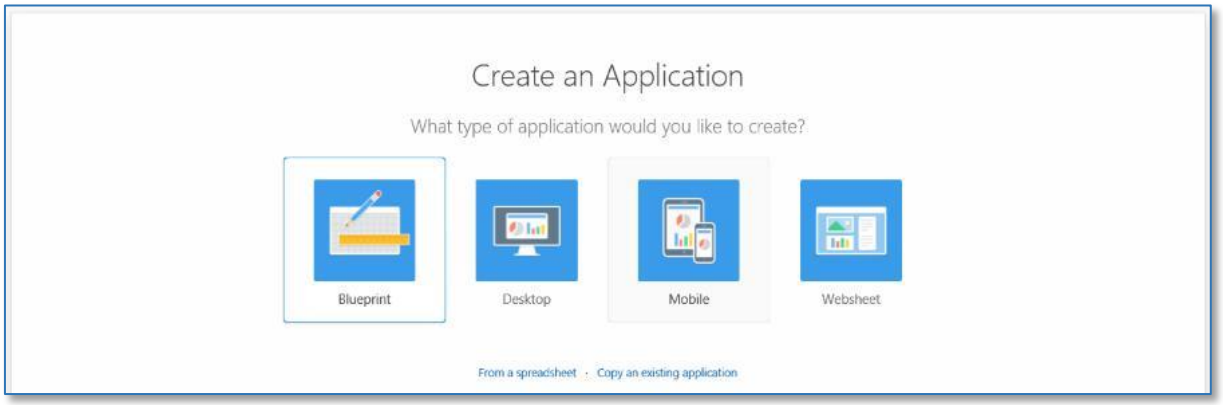

Figure 3 - Application Types

Within each application, there are various types of pages that can be added. The wizard makes this process very simple, although you can create a blank page and add the required controls manually.

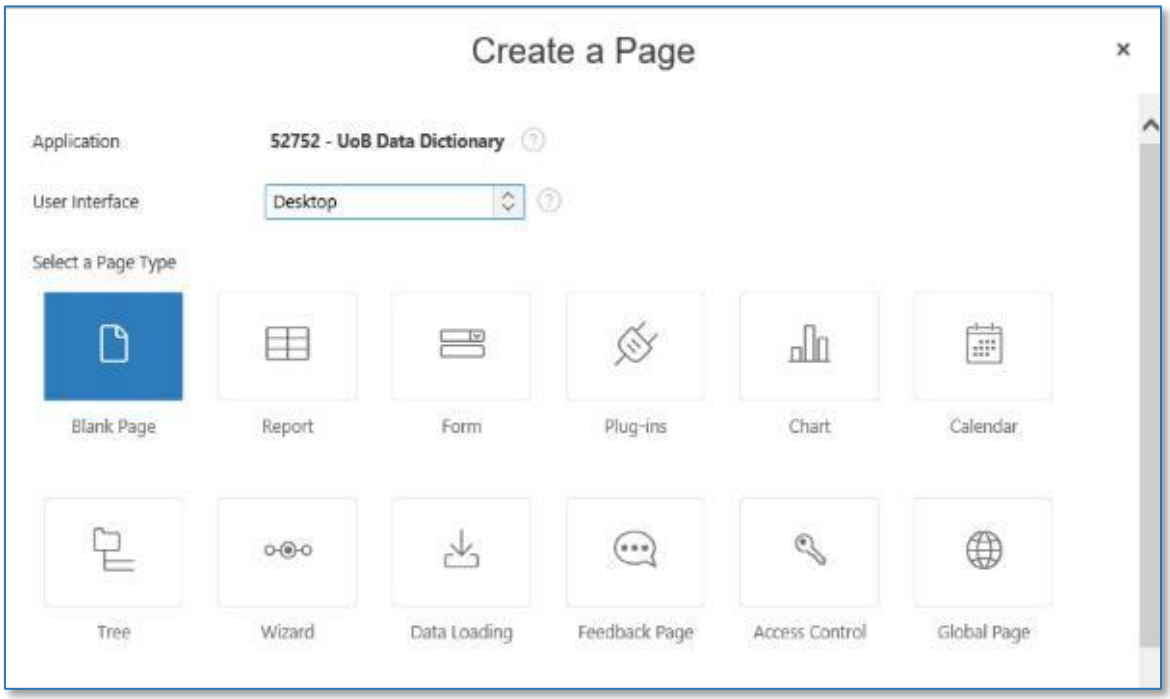

Figure 4 - Page types within Application

Within each 'page type' there is a further subset of types. In *Figure 5*, the subset of a form page are shown. You have options such as master detail forms and report with form on table (which is a table listing of records with an automated edit form).

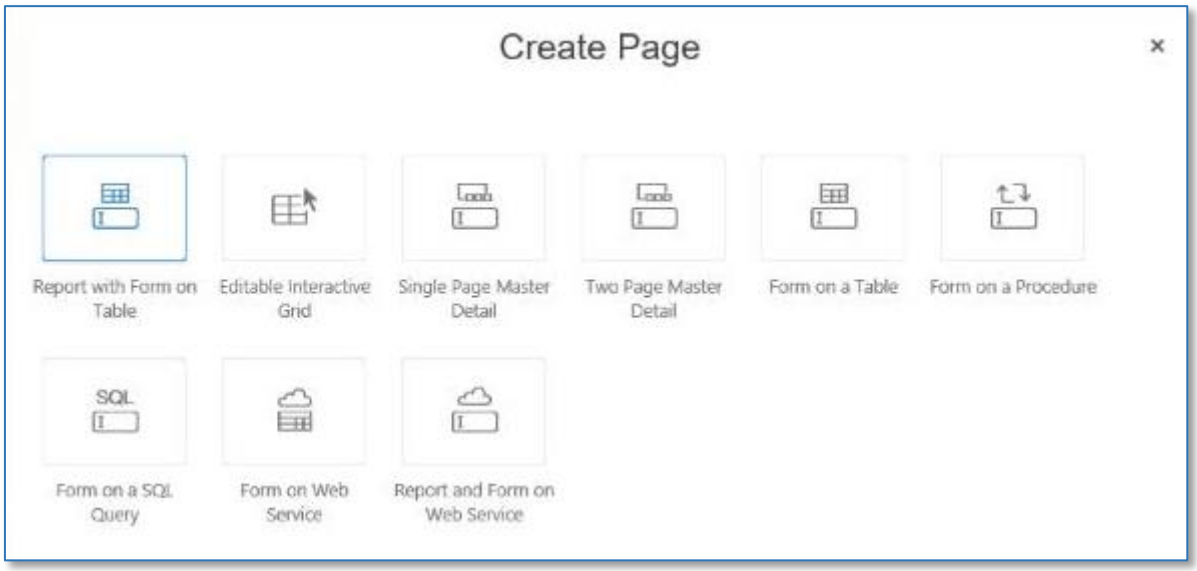

Figure 5 – Form Page subset types

Once created, each page is listed separately under the application and can be modified using the edit page options. *Figure 6* shows the page content within an example application.

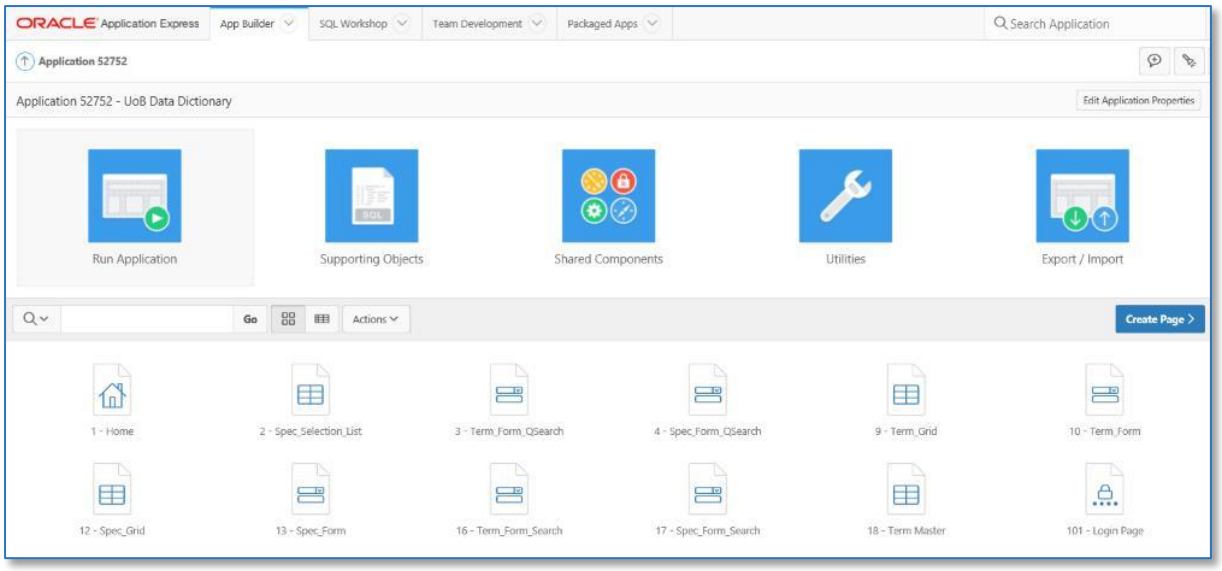

Figure 6 - Example Application Content

Clicking on any page item takes you to the page designer, where you can modify the page content. The page designer is very detailed and can appear very complicated with all the options & settings available. There are two main ways to view the page content: Layout View or Component View. The Layout View attempts to show you the page content as a visual representation. It displays the content as areas, which are laid out as ordered on the screen. It is not an exact representation of how the page will appear when you run it but gives you a general layout of components. *Figure 7* shows the page designer view of a data entry form in Layout View.

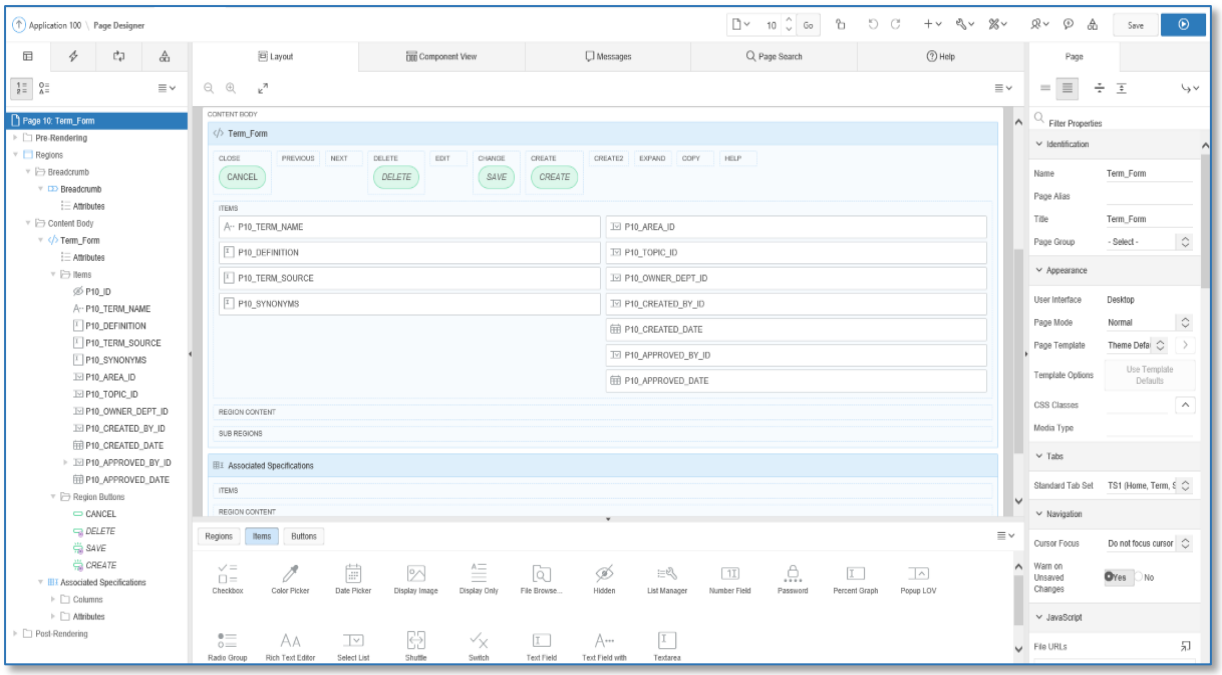

Figure 7 - Page Designer Layout View

The Component view is a non-visual representation of the page, where components and items are grouped into categories within the page. This view allows you to view all page items & shared application components easily. *Figure 8* shows the same data entry form as Figure 7 but in Component View.

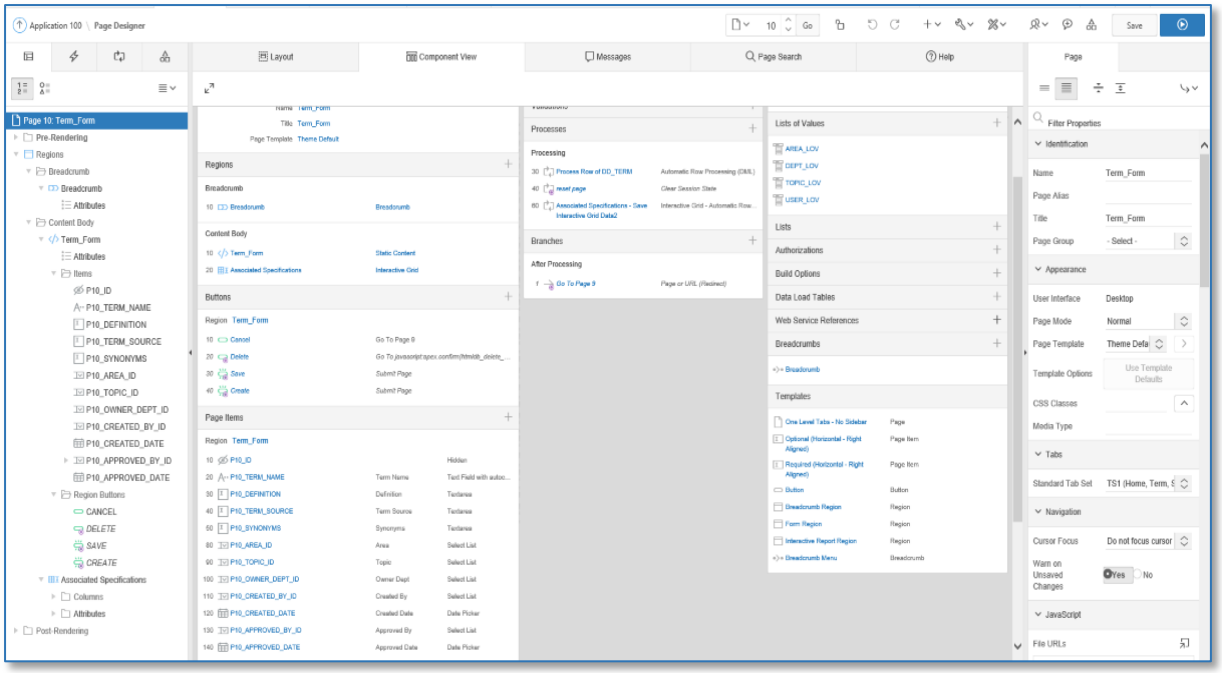

Figure 8 - Page Designer Component View

Both the Layout View & Component View have the item listing tab on the left side of the screen and the properties tab on the right side of the screen. Each item on the page has it's own set of properties that can be modified. Additionally, the item listing tab on the left has additional tabs such as dynamic actions, which allow you to add an action to an event or control (i.e. populate a text field with a default value on a button click).

The APEX development environment is highly flexible and allows quite a lot of customisation using various development options. You can create customised HTML tweaks, add CSS to items and create scripts in JavaScript. Linking to the database also allows flexible options with creating queries in SQL, PL SQL Functions or static content.

Apart from the options & components within a specific page, you can create application-wide shared components. There is a wide range of options for creating shared components, such as List of values, plug-ins, navigation options, etc. *Figure 9* shows the list of options available for shared components within an application.

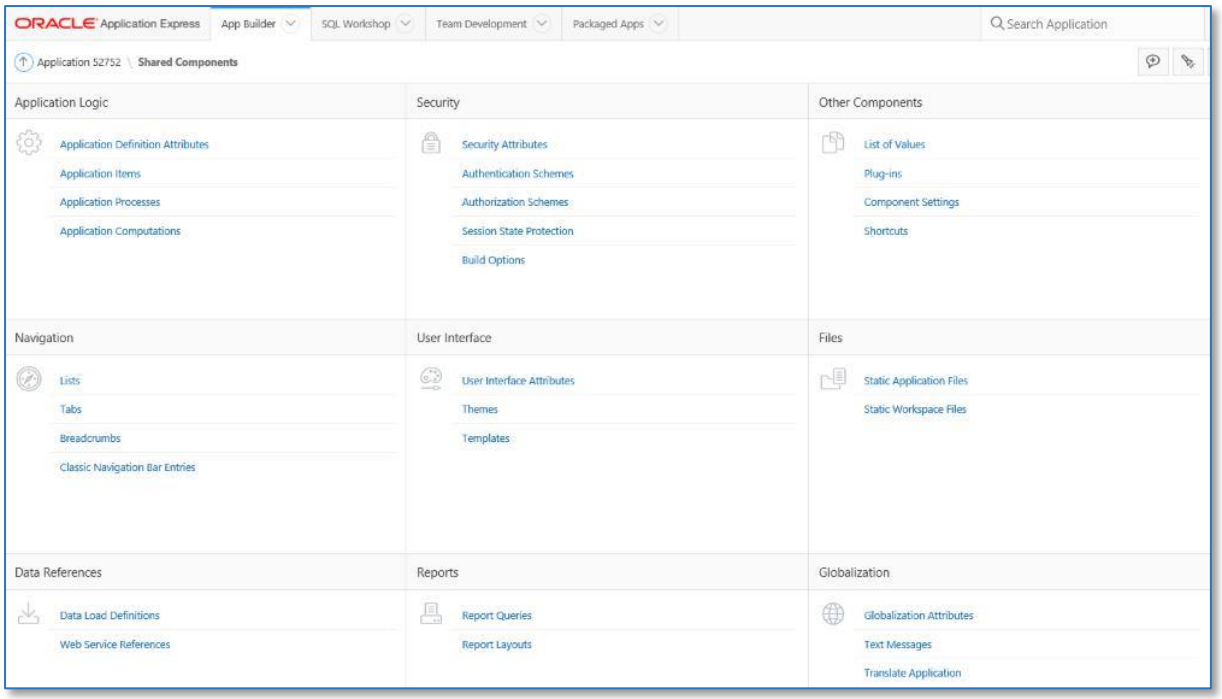

Figure 9 - Application Shared Components Options

2.3 APEX SQL Workshop

As well as a development environment, APEX also has a database management tool embedded in it. This DB management tool allows you to carry out the fundamental tasks to create a working database – create tables, create views, run scripts, run SQL queries etc. *Figure 10* shows the SQL Workshop home page

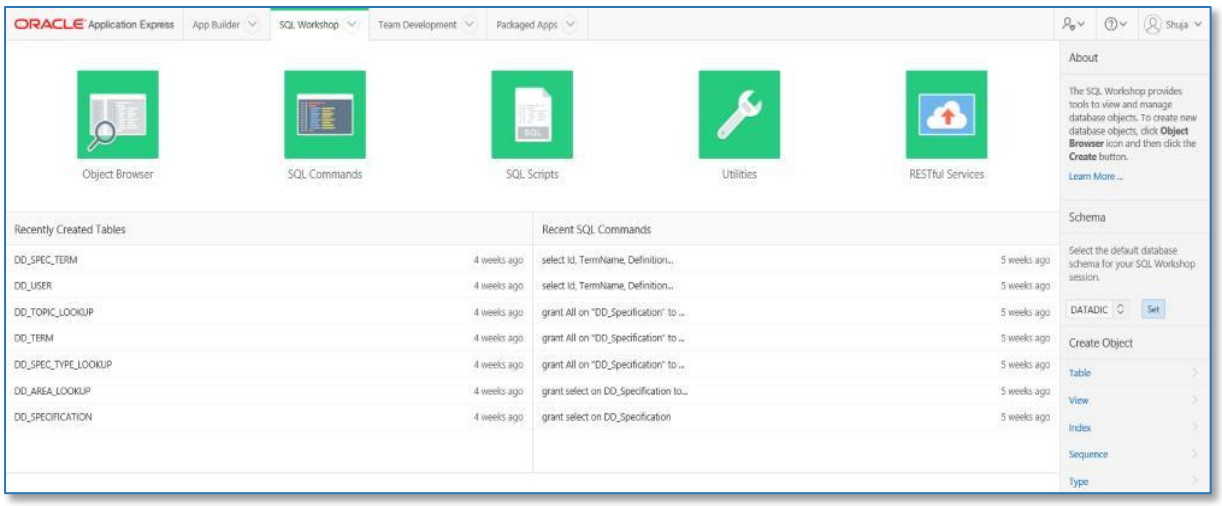

Figure 10 - SQL Workshop Home Page

The object browser allows you to view/edit/delete database objects such as tables & views. You can also view the data within tables & apply constraints, indexes, triggers, etc. as you would in a standard DB management tool.

Ref: Oracle APEX Evaluation 21/06/2017,
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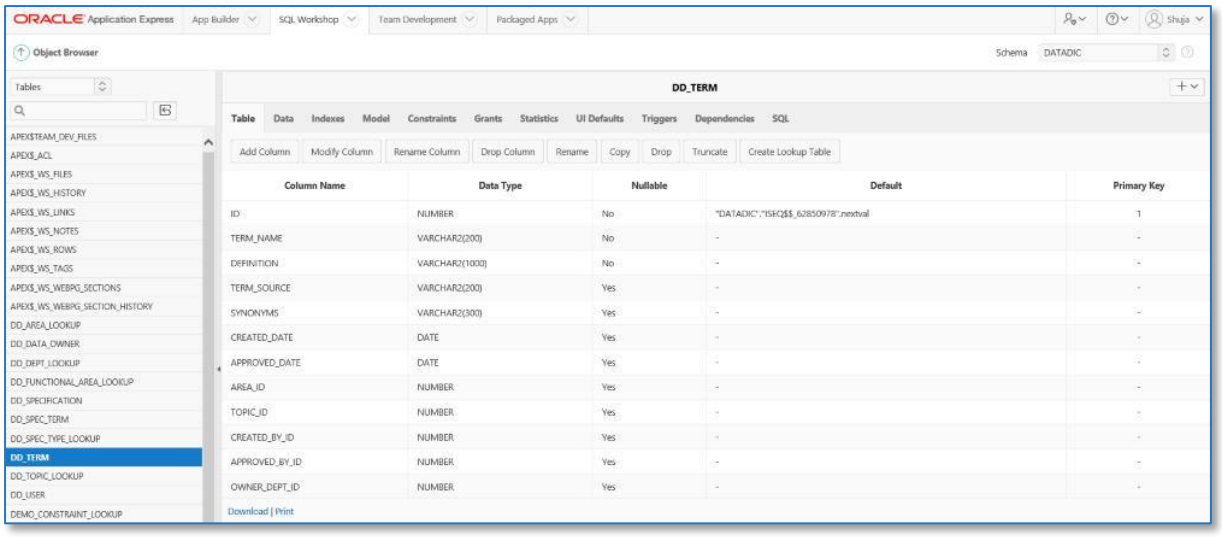

Figure 11 - DB Object Browser

2.4 APEX Utilities

In newer versions of APEX, the 'Utilities' tool has been moved into the SQL Workshop section but still contains the same features as when it was a separate tool. Within the utilities tool, you can import & export data, use the query builder to create queries using a graphical user interface, find deleted objects & recover data, etc.

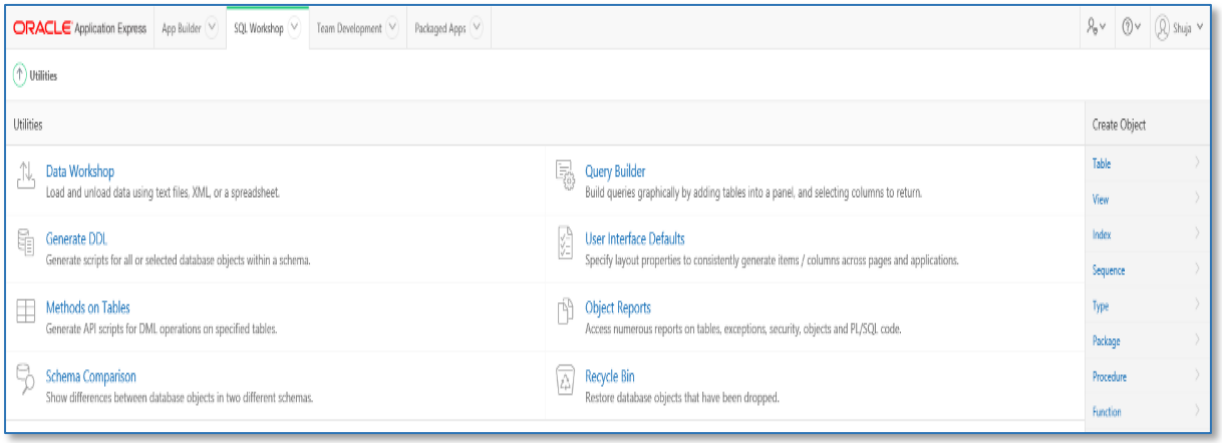

Figure 12 - SQL Workshop Home Page

The Data Workshop option allows you to import data into the database, to either a new table or an existing one. You can import from existing spreadsheets that have been used as data repositories. This feature is extremely useful and very simple to use, as you can import data using the automated wizard feature without having to know how to create a table. The wizard defines the table structure, columns & data types automatically based on the data being imported.

3 Impact on Organisation

Currently, the UoB IT services have limited methods of delivering RAD web applications. Small web applications, database apps or departmental sites are usually created through SharePoint. This method is relatively easy, quick and can be useful for creating standardised sites. However, SharePoint sites are not very flexible (without plug-ins and add-ons) and require a level of technical knowledge in order to create the basic functionality expected from a data-driven site. In addition, the SharePoint product has a negative image associated with it within the University, where users are often not keen on having their data/files published on SharePoint or to have their web sites created in SharePoint. SharePoint has it's use as a RAD web site/app publishing tool but isn't considered a great RAD development tool and, without additional plug-ins or an in-depth technical knowledge, it is not easy to create flexible, customised data-driven web applications.

Within the university, there are many legacy database apps developed in MS Access & MS Excel. Whenever there was a need to capture data quickly, departments/staff usually decided to create ad-hoc, in-house MS Access databases/applications, which were unsupported & developed unprofessionally. Data is also captured and stored in MS Excel Spreadsheets. Data within MS Access databases & MS Excel Spreadsheets is not easily accessible or shared. The files would have to be placed in shared network folders or uploaded as a shared file on SharePoint. Neither of these solutions is suitable, as multi-user sharing/amendments becomes an issue on both shared network folders & SharePoint and there is a great risk of data/file corruption.

Small to medium sized web development projects that are not being developed in SharePoint or database applications that are not being created in MS Access / MS Excel are currently not being developed in any kind of RAD methodology or RAD environment. If a web/database app is required, the development team will follow a formalised methodology and develop in .NET technology or Java. This methodology can be slow, time-consuming and unnecessarily delay simple development projects (to the point where they are scrapped or no longer meet the business need they were requested for).

The APEX tool can be used within the IT Services development teams to provide a RAD development solution for small to medium sized web/database application projects. All the hardware & software requirements for developing in APEX are already available within IT services and the tool is free to use. Additionally, the support required to configure the APEX tool and to develop within the environment already exists, as the Oracle DBA team has the relevant expertise for this.

The use of APEX as an IT Services development resource would allow development teams to produce fully functional, data-driven web applications at a quick rate and so aid productivity & project delivery. APEX may not be a feasible consideration as a development environment for large or enterprise-wide projects but for small, ad-hoc projects or projects which need swift delivery, it can help achieve quicker delivery of professional web applications.

Using APEX for database applications could also help replace the need for legacy MS Access databases and could help reduce the number of new MS Access applications being developed in an ad-hoc manner. Creating database applications in APEX would allow for better accessibility & sharing of data, as applications are web-based and accessible from a web browser. It would also

improve security of data and reduce risk of data corruption, as the applications are based on Oracle database technology.

3.1 SWOT Analysis

STRENGTHS

- Quick & effective development tool for web applications
- No additional costs, as it is free with the Oracle Database product.
- Requires only limited programming experience
- Develop & deploy professional applications that are fast and secure
- Development environment is completely web based
- Combines the qualities of a personal database, productivity, ease of use, and flexibility with the qualities of an enterprise database, security, integrity, scalability, availability and built for the web.
- Integrates web development & database management tools into one environment
- Online community support seems mature and well listed

OPPORTUNITIES

- Replace the need for stand-alone MS Access databases / applications and MS Excel spreadsheets being used as data stores for key data.
- Could be used to develop sites currently being created in SharePoint (departmental sites, event sites, etc.)
- Potential to aid team development and shared working practices.
- Allow users with limited development knowledge to quickly build fully functioning applications (including prototypes, temporary sites, report or chart dashboards, etc.)
- Increase development teams productivity & project delivery times

WEAKNESSES

- Although designed to be relatively easy to use, the dev environment can be difficult to grasp, as it has a vast amount of options, settings & sub options
- Naming conventions of options & settings can be confusing & unintuitive
- May not be suitable for developing medium to large scale web projects.
- Supplier (Oracle) support & documentation is weak
- Learning curve for DB & application development using the APEX environment.

THREATS

- Development teams may provide resistance in using this tool, as they may prefer their own methods.
- Transferring small MS access applications into APEX may cause issues with users, who were used to a certain way of working.
- Developing good quality applications in APEX may still be more time consuming than creating an MS Access DB or Excel spreadsheet to capture & report data
- Only trained developers/users would be able to develop in APEX environment.

4 Conclusion

The APEX development environment is ideal for RAD web application projects and provides a comprehensive set of tools & features to help aid development.

For the UoB, using the APEX tool seems like a straightforward option. It is already available and configured as part of the Oracle database product that the university has procured, the relevant expertise and support is available through the Oracle DBA team, and the tool will allow developers to create professional RAD web/database applications (potentially) a lot faster than current, formalised methods of development. Additionally, creating apps within APEX would ensure a more secure, robust environment as well as allowing better access management & easier data sharing across the enterprise.

Developing database applications in APEX could help with replacing key legacy MS Access databases that exist within depts. This would help centralize the management of data and improve data transparency & cataloging. It would also deter staff from creating new ad-hoc local MS Access database if they had the option of requesting an APEX application that can be delivered in a timely manner.

SharePoint could still be a feasible & useful tool to create sites but adding APEX as an option would increase the flexibility for developers & users. It provides a more customizable dev environment, where you can produce more complex apps with much more of a professional look & feel to them in comparison to standard SharePoint sites.

Although the APEX tool does not require a great deal of development knowledge or experience to use, it still requires a bit of a learning curve to understand all the various options & settings available. It would probably be more suited to existing software & database developers, as they would be familiar with the environment concepts. However, it could be feasible to provide training & support to non-developer users in order for them to be able to create basic web applications within the APEX tool. This would help reduce workload for the IT dev teams & allow the flexibility for depts. to still create their own web or database applications but within a more professional, secure & robust environment.

The combination of IT dev teams developing & delivering small web/database applications quicker, replacing ad-hoc MS Access database developments with a more secure & professional product, and potentially allowing non-development staff (with some training & support) to create basic web applications themselves all suggest that the APEX environment is an ideal RAD web development tool for the UoB.

5 Evaluation Matrix Scores

Area	Scoring System	Score	Reason
Maturity	1 = Idea 5 = Mainstream Product	5	The APEX RAD tool has been available as part of the Oracle database product for many years and has been upgraded and improved with each iteration.
Technology (Adoption timescales)	1 = > 3 years 5 = < 3 months	5	The technology to enable APEX development already exists within the organisation and the expertise to manage this exists too within the Oracle DBA team
Business Process (Adoption timescales)	1 = > 3 years 5 = < 3 months	5	There is very little required in terms of business processes to adopt the APEX RAD tool. It is ready to use for small – medium projects.
Adoption Overview	1 = v long time 5 = very short	5	As the technology required & the business processes are already in place, adopting APEX as a RAD tool would be easy & quick to implement
Existing Technology (Impact)	1 = v large impact 5 = very little	5	There is little or no negative impact on existing technology. Using APEX could make MS Access & Excel spreadsheet applications redundant. This would be a positive impact due to the improved security & web-based access.
Resources Required	1 = v large impact 5 = very little	3	In terms of hardware or tech, there are very little new resources required (apart from server & database space). However, developer & user training would be required.
Scope	1=very difficult 5=very easy	4	Professional & secure web applications can be developed very quickly using APEX so the scope is very wide. However, initial implementations may be for small projects and in-house developments
Usability	1=very difficult 5=very easy	4	Development environment is quite complicated & can take time understanding/getting used to. But end product usability should be simple & straightforward given the themes & options available in APEX.
Security	1 = very poor 5 = excellent	5	Based on Oracle database security, APEX applications have various built-in security features and options.
Innovation Value	1 = low innov. 5 = high innov.	4	Although the APEX tool isn't the most innovative tech around, nor the latest, it allows rapid app development with vast features to add innovation to your applications.
Cost Effectiveness	1=very expensive 5=very cost effective	5	The APEX development environment comes free as part of the Oracle Database product so is completely free and has no additional license or support costs.
Adoption Readiness Score	*<20 - not ready 20-29 - emerging 30-39 - Adoptable >39 Fully Ready*	*40*	*The APEX tool is a great, feature-filled, secure web application development tool, which is ready & supported within the organisation. It could help replace ad-hoc MS access applications & Excel Spreadsheets created to capture data locally, which can be insecure, poorly managed & limited in accessibility. The APEX tool is also free to use.*

***Note**: Rows that have no highlight colour indicate the score value is not added to the adoption readiness total. Instead, the overview score for that area is used as part of the total score.*