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Black Radley: Understanding commercial performance in museums

Research & Development Report

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Background

These are troubled times for the cultural sector. In the wake of the ongoing reductions to public funding, museums and other cultural organisations are increasingly looking for alternative sources of income.

The drive to become more commercially astute is something that has gained momentum in recent years. Growing numbers of organisations are placing a greater emphasis on generating income through commercial activity; in particular, maximising visitor spend.

Museums are unique; unlike a shop or a restaurant, where numerous studies have been undertaken to understand what stimulates spend in those environments and indeed a discourse of best practice has evolved to respond to the marketplace, very little information exists on what drives commercial growth in the museum environment.

Many have a shop and a café, some charge for admission and some run special events. This consistency means that it might be possible to compare the commercial performance of museums together as a group, and discover exactly what factors are important in determining visitor spend and therefore commercial success.

The Project

In 2014 Black Radley formed a project partnership with Bath Spa University and The Ryan O'Neill Partnership to attempt to discover what factors drive visitor spend in the museum environment. This project came to be known as 'Insight'.

Major advances in accessibility and applicability of machine learning technology meant it was now possible to determine which factors most affect museum performance and to use those factors to determine what the "ideal" expected performance might be for an individual museum.

In order to do this, the project partners needed to understand:

- The best way of categorising museums based on commonality of offer (i.e. 'museum', 'castle', 'historic house', etc), that would also allow for

representation of the differences between individual sites as related to visitor spend (i.e. presence of shop, frequency of events, etc);

- The most likely 'internal' factors that have potential to influence visitor spend (i.e. marketing activity, scale of the site and its component parts);
- The most likely 'external' factors that have potential to influence visitor spend (i.e. local demographic profile etc.);
- The most appropriate means by which to collect this information;
- The most appropriate means by which to report back the findings.

After a process of rigorous research and in consultation with a steering committee of museum sector representatives, an online platform was designed and built enabling individual museums to:

- Identify their *type* of site through a set of common criteria;
- Provide data about the kinds of activities undertaken at the site (i.e. marketing resource, and component parts such as type of shop and associated product lines, type of café offer, frequency of 'special events' etc.).
- Submit performance data for each of these key component parts;
- Access a personalised report which projected expected income for each of these component parts based on an analysis of data provided by participating sites and wider 'environmental' data such as demographics of the surrounding area;
- Access toolkits enabling museums to best respond to their personalised reports.

Results

Despite high initial interest from the sector, eventual participation rates were low. During the life of the project significant resource had to be redirected to increasing the levels and quality of data submitted. Eventually only 64 out of 200 participating sites were able to provide a full 12 months' worth of data.

It was decided that the focus of the research had to change direction in order to account for this unexpected outcome. The reason for this was that the process of encouraging museums to take part revealed that in many cases the degree of challenge museums experience to take part in such projects had been underestimated; these challenges have direct implications on the sector's ability to successfully respond to future funding reductions.

The new direction of study resulted in four common 'barrier to entry' themes being identified:

- Use of outdated technology within the sector;
- Negative perceptions of data projects;
- Inefficient internal flow of information within organisations;
- Limited capacity to take part in non-core activity.

Despite low participation rates, the project was able to ascertain a statistically significant relationship between a variety of factors relating to commercial income, including:

- Sites are likely to have increased visitor numbers if they identify as a 'Museum' or 'Castle';
- Population density, presence of a café and having a larger museum has a positive effect on the amount a museum receives from (or can charge for) admission income;
- Retail income is related to catering income (i.e. if a café is present, people are more likely to spend in the shop and vice versa);
- Retail income is positively influenced by visitors having to exit through the shop;
- Retail income is positively influenced by the presence of additional events;
- Museums who identify as having a 'park' as part of their offer are likely to see higher refreshment spend;

- Museums who provide ‘full meals’, vegetarian options, tea and coffee as part of their catering offer are likely to see increased refreshment spend.

Future

Overwhelmingly the response has been that further research is required to gain a deeper understanding of the factors that play a role in determining commercial performance. This is of course dependent on successfully resolving the challenges faced by museums that prevented participation in this study. Future opportunities for this study include:

- Expanding the scope and power of the toolkits (and associated methods of deployment and implementation) to address the underlying sectoral issues the study uncovered;
- Persevering with data collection activities directly with museums;
- Combining data with that of other data collections and analysis projects to add depth and robustness to the analysis, join up findings, and demonstrate the value of combining research studies to add leverage to currently independent projects.

However, it is the belief of the project partners that the clear priority is to set about addressing the underlying difficulties the sector faces which prevented participation. These difficulties not only had implications for the Insight project, but will likely hamper the sector’s ability to successfully meet the financial challenges ahead.

The project partners are actively collaborating on the pursuit of future projects which aim to address these challenges.

Background

Museum Sector Context

These are troubled times for the cultural sector. In the wake of the ongoing reductions to public funding, museums and other cultural organisations are increasingly looking for alternative sources of income.

The sector's reliance on the public purse is being challenged as never before, leading to debates around the purpose, use and even value of our cultural institutions. Sector representatives such as the Creative Industries Federation (CIF) are vocal about the value of a publicly funded cultural sector. In July 2015 reports by CIF and Arts Council England (ACE) stated that:

- Arts and Culture is worth £7.7bn in gross value added to the British Economy, an increase of 35.8% between 2010 and 2013;
- For every £1.00 invested in Arts and Culture, an additional £1.06 is generated in the economy;
- Britain invests a smaller percentage, 0.3%, of its total GDP on arts and culture than other countries. Germany invests 0.4%, the EU as a whole 0.5%, Denmark 0.7% and France 0.8%.

However, it has also been argued that the UK's investment in arts and culture is high when compared with elsewhere in the world. Martin Smith, Special Advisor at Ingenious, a leading financial services group, argues:

> "Very few countries are allocating more public money to the funding of arts and culture unless they are very small and very rich (such as Norway and Qatar). We can (and should) argue about the direction of cultural policy and public funding in the UK, but the general trend is clear and is unlikely to be reversed in the foreseeable future. The future of the arts and culture sector, in the UK as elsewhere in Europe, will increasingly be about finding new ways of using public money to draw in private money in a variety of configurations, using a variety of instruments."

With another Government spending review due in November 2015, the debate around cultural funding has intensified. The question is not whether funding will decrease, but *by how much?*

Financial[1] and cultural sector leaders alike have recognised that given the current financial projections, many cultural organisations are simply unsustainable. The impact on museums has already been demonstrated in previous funding reductions. According to research undertaken by the Museums Journal, 42 museums, galleries and heritage sites had closed between 2002 and 2012. Over 30 of those closures had occurred since 2010.

The ability to generate revenue from other sources is key if an organisation is to survive in the current funding environment. The drive to become more commercially astute is something that has gained momentum in recent years. Growing numbers of organisations are placing a greater emphasis on generating income through commercial activity. In the 'mixed model' context in which museums exist, a component of this activity is maximising visitor spend.

Visitor spend, historically, has not been a primary objective of Museums; they have developed to become complex institutions with multiple objectives and demands placed on them. They are quite unlike any other commercial organisation in both their goals and execution. This makes the task of managing a museum particularly challenging.

Fortunately museum managers do not work in isolation; they are part of a vibrant community of museum specialists who they can turn to for ideas, information and support. Whilst museum managers and their funders readily share performance information, making effective comparisons between museums is difficult. Comparisons tend to be anecdotal and managers are left to make subjective judgements about whether those anecdotes apply to their particular situation. In essence, how can we be sure that the right information is being measured and acted upon? Furthermore, what is the 'right information'?

In terms of growing commercial income from visitors, the funding context described above and lack of robust data highlights the need for a greater understanding the factors that drive people to spend money in museums.

Museums are unique; unlike a shop or a restaurant, where numerous studies have been undertaken to understand what stimulates spend in those

[1] http://www.theguardian.com/culture-professionals-network/2015/jun/18/arts-creativity-finance-funding-evolve

environments and indeed a discourse of best practice has evolved to respond to the marketplace, very little information exists on what drives commercial growth in the museum environment.

Despite their complexity, museums can be remarkably similar. Many have a shop and a café, some charge for admission and some run special events. This consistency means that it might be possible to compare the commercial performance of museums together as a group, rather than making ad hoc anecdotal comparisons between individual museums. In theory, this consistency also allows us reduce the potential scope of what factors are inherent in determining commercial performance, which this project aimed to explore.

Project Partners

In 2014 Black Radley formed a project partnership with Bath Spa University and The Ryan O'Neill Partnership to attempt to answer some of these questions. The need and opportunity was clear.

Black Radley specialises in providing consultancy support for public services. They work with the public sector, not-for-profit organisations and commercial businesses to provide excellence in business planning, change management, enterprise development, and effective governance. In the light of the financial pressures on the cultural sector, their expertise has been in high demand from cultural organisations over recent years.

Bath Spa University offers a wide range of courses across the arts, sciences, education, social science and business to 7,000 students, the University employs outstanding creative professionals, which support its aim to be a leading educational institution in creativity, culture and enterprise.

The Ryan O'Neill Partnership is a small commercial software company with 4 in house software developers, who collectively have 60 years of experience in professional software development. Since 2011 the Ryan O'Neill Partnership has focused on the .NET platform using it to deliver high performance retail websites and back office systems.

Machine Learning and its application within the museum sector

In the spring of 2014, having seen major advances in accessibility and applicability of machine learning technology, The Ryan O'Neill Partnership approached Black Radley with an idea; using machine learning techniques it might be possible to determine which factors most affect museum performance and to use those factors to determine what the "ideal" expected performance might be for an individual museum.

Machine learning is a subfield of computer science concerned with the development of algorithms that can learn from and predict data – effectively, the machine (algorithm) *learns*. This is also referred to as *predictive analytics*, a close relation of computational statistics. In the developing discourse around Artificial Intelligence, Machine learning has been a field of study for decades, but has gained momentum since the 1950s.

This provides an indication of the principles behind machine learning. In terms of application, today the use of machine learning is widespread and continues to grow. For example, it is being used to detect credit card and internet fraud, to analyse economies and the stock market, and in 2006 Netflix utilised the technology to better predict user preferences and improve accuracy of its film recommendation algorithm.

In this context, it is easy to see how machine learning could have utility in terms of museum commercial performance, however it is also crucial to understand how the results of such an endeavour could be interpreted. To do this, Black Radley and the Ryan O'Neill Partnership approached Bath Spa University's Humanities department to join the project as a research partner and advisor. Bath Spa University were keen to take part in this project as it was felt that any outcome of this research would benefit not only the museums sector, but the next generation of museum professionals through Bath Spa's MA in Heritage Management course. Through Black Radley's work in the sector, one of the most common issues identified by clients is that recent graduates in the sector demonstrate a skills gap in terms of sustainable business practice. Through becoming the Research Partner for the Insight Project, Bath Spa University sought to utilise any learning to better prepare

undergraduates for the commercial challenges they would likely face in their future careers.

Collectively, the opportunity to utilise machine learning to develop an online platform which measures and then predicts commercial performance informed by a variety of contextual factors, allowing museums better data from which to make more informed decisions, could be realised.

The Project

Overview

The project aimed to analyse and understand the factors specific to museums which have the greatest impact on visitor spend. In order to provide this analysis we needed to understand:

- The best way of categorising museums based on commonality of offer (i.e. 'museum', 'castle', 'historic house', etc), that would also allow for representation of the differences between individual sites as related to visitor spend (i.e. presence of shop, frequency of events, etc);
- The most likely 'internal' factors that have potential to influence visitor spend (i.e. marketing activity, scale of the site and it's component parts);
- The most likely 'external' factors that have potential to influence visitor spend (i.e. local demographic profile etc);
- The most appropriate means by which to collect this information;
- The most appropriate means by which to report back the findings.

Advances in machine learning suggested that it should be possible to predict visitor spend using data collected from museums, in combination with wider data sets (known as Big Data analysis).

The ability to analyse this information should therefore provide insight in to what factors actually drive visitor spend, which would allow museum managers to make more informed decisions about the activity they undertake, and indeed establish a framework for best practice to help the sector safeguard against further funding cuts.

Begun in September 2014, this study came to be known as the Insight project.

Interface

To guide the project, a steering group was established which comprised of leading museum professionals and analysts. In consultation with this group the project partners established which factors were crucial to measure and

their perspectives formed the basis of the eventual interpretation of the findings.

Key to any machine learning project is having a large body of representative data. Despite the hype surrounding "Big Data" and data driven decisions (or perhaps because of it) the issue of gathering and marshalling data is a secret hidden in plain sight. For most data driven projects, gathering and marshalling the data is typically the largest cost. In order to reduce this cost it was decided to allow museums to gather and enter their own data rather than do to the expense of employing researchers to gather the data. This approach has both benefits and risks. A potentially larger data set can be gathered at a substantially lower cost. However, since many different individuals from different organisations are entering the data there is a great potential to introduce inconsistencies into the dataset.

In order to reduce the inconsistencies in the dataset a bespoke web interface was developed to allow museums to report their performance data. This interface would also be used to disseminate each museum's commercial analysis and provide support on the interpretation and applicability of their findings in the form of toolkits.

Having established a framework of datasets to inform the design of an online platform for the submission of data, in November 2014 Black Radley embarked on a process of reaching out to the sector for museum participants who were willing to volunteer their time and data in return for an analysis of the primary drivers of visitor spend specific to their site.

The initial designs and subsequent build of the platform occurred over the period from November 2014 and February 2015 for the initial 'data submission' element. The interface was designed to be secure whilst presenting a low barrier to entry. Users were to be given free and immediate access to allow them to enter their own data without being able to view the data provided by other users. Entering data into web forms has become a common process for the modern administrator. In order to make the process less onerous very few of the fields in the form were required. Users would be allowed to progress without completing all the fields. Whilst this approach inevitably leads to some missing data, it reduces the frustration for the user. Additionally the profile of missing data can also be informative in itself.

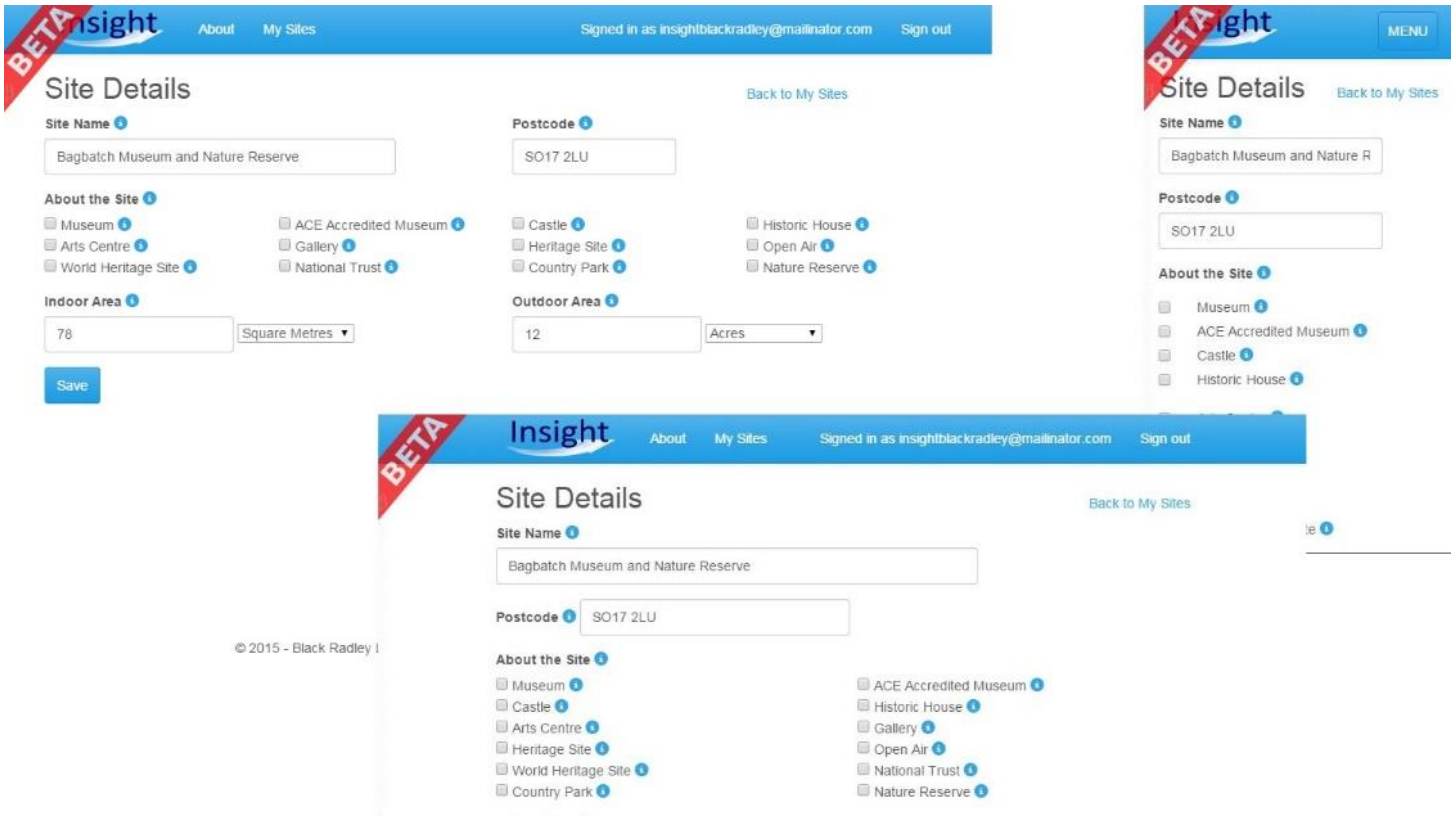

Figure 1 Insight Interfaces

Consistent with attempting to minimise the barriers to entry the web interface was designed to adapt to the different platforms which might be used. The image above shows the interface on a conventional desktop, a tablet and a smart phone. Some of the data requested (such as distances within the museum) might conceivably be gathered while walking around using a mobile device. Indeed users were allowed to enter distances in paces, as well as metres and feet.

Response

Despite high rates of initial interest from the sector, participant sign up was low, and data submission rates lower still. By March 2015, over 800 approaches were made to Local Authorities, individual sites, and development and membership organisations. Publicity for the programme also appeared in trade publications and messaging was distributed via funders. Over the course of six months, nearly 200 museums joined the project. Of the museums which joined the project 96 began entering data but by August 2015 only 62 museums were able to provide information covering 12 months of museum performance. Of the 34 museums which

began entering data but did not enter sufficient data, the majority (70%) did not provide any monthly data.

The museums taking part in the data entry did not work in isolation. Contact was maintained with the museums entering data allowing them to raise issues and questions about the interface. Additionally, the museums which signed up for the study but were not able to enter data was contacted directly for feedback.

Outcome

Being heavily reliant on the data provided by participating organisations, having submission rates that were lower than expected had implications for the depth of analysis the project partners were able to provide. Despite this, the Insight team were able to find relationships between factors which do have utility for the sector, albeit not as sophisticated or well informed as the team had envisioned. Moreover, the project's success in identifying these relationships indicates that the Insight study, or similar studies, can play an extremely useful role in enabling the sector to better understand itself and its users, should the barriers to data entry be addressed in future iterations.

The machine learning techniques employed can determine which factors are significant. However, interpreting their meaning is much more challenging. Whilst it is clear which factors are significant, understanding the meaning of that significance is not so easy.

Machine learning techniques are specifically designed to handle 'noise' (irregularities) within the data and to provide confidence limits for projects which take account of the noise. The data collection phase took a deliberately liberal approach, placing as few restrictions on the data entry process as possible. This undoubtedly allowed for a larger volume of data to be collected but also resulted in the fact that some of the entries were incomplete or in error. Specific techniques are available to deal with missing data but handling erroneous data is much more challenging. For example the maximum indoor area provided was in fact 12,000 square metres. This is about 3 acres, for a small museum in the middle of a provincial town. Whilst this is probably the wrong value, without contacting the museum in question is it not possible to determine what the correct value should be. It might be possible to check apparently erroneous values but this would arguably lead to a bias in the data. For the time being no data has been

"corrected" but it does lead to the wider question of why the errors are occurring. It is especially interesting in that the commercial performance figures seem particularly prone to errors. In some cases values were apparently two orders of magnitude greater than might be reasonably expected.

A New Direction

In light of the low participation rates, by June 2015 Insight was propelled in a direction that the project partners had not anticipated; this direction led to a re-evaluation of the initial objectives, impacting on lines of inquiry, the outputs and ultimately the overall findings and associated implications for the museum sector.

Bath Spa University and Black Radley embarked on journey to understand why the project was not gaining as much traction in the sector as anticipated. The project partners uncovered themes that had the potential to significantly impact on visitor spend that had not been anticipated. The emergence of these themes was based on qualitative data rather than quantitative; a result of the process of undertaking the study rather than a result of the study itself. The question of *why* Insight was resulting in certain phenomena became just as significant as the findings themselves. For example:

- Why was there so much initial interest in the study, yet such a significant reduction in participants?
- Why were museums reluctant to submit data?
- Why were certain data fields omitted?
- Why was some of the data inaccurate?

Throughout the summer of 2015, following careful consideration of these questions, examination of the available evidence, analysis of the technology being used to access the interface, and consultation with the steering committee, Black Radley and Bath Spa University identified the themes underpinning these questions as:

- Use of outdated technology within the sector;
- Negative perceptions of data projects;

- Inefficient internal flow of information within organisations;
- Limited capacity to take part in non-core activity.

In commercial environments these themes are seen as critical to an organisation's ability to make decisions and be responsive. The evidence of consistent difficulties across these themes in a museum environment exposed worrying implications for the sector.

In order to respond to these findings, it was decided in July of 2015 that the Insight project would proceed as planned in terms of delivering bespoke analyses for participating sites, as despite the quality of data useful projections could still be made. If the project were to be developed further, and greater volumes of data submitted these analyses would become more powerful with greater utility. However, it was decided that the focus of the toolkits had to be radically redesigned; if the current operational context of museums led to poor data and lack of data availability, deploying a toolkit based on how to interpret an analysis of that data would make only marginal improvements in commercial terms. By far the greater need was identified as being deploying tools to tackle the underlying organisational problems which led to the 'data bottleneck'.

The new toolkits instead explored the four pillars of organisational health:

- **Organisational fitness;** This toolkit explored what Organisational Fitness looks like, including:
    - How to achieve a balance of *purpose* (Political, Operational, and Financial perspective);
    - How to achieve a balance in *people* (Control (i.e. management styles), Engagement, and Enterprise perspectives);
    - How to achieve a balance in *processes* (Operational, Infrastructure, and Customer perspectives);
    - A *Balanced Performance Framework* which enables organisations to carry out an analysis of their organisational fitness and discern key actions for change.
- **Organisational flexibility**; This toolkit explored:

  - How to create an enterprising *context*;
  - How to encourage enterprising *behaviours*;
  - How to ensure organisations collect the right *knowledge* for enterprise to happen;
  - An *Enterprise Engine Framework* which allows managers to track organisational responsiveness.

- **Organisational strategy;** This toolkit explored:
  - What Strategic Success looks like;
  - Applying strategic intent to business fundamentals, including:
    - Programming
    - Fundraising
    - Trading Activity
    - Asset Management

- **Organisational Change;** This toolkit explored:
  - How to apply the knowledge from Kits 1 – 3;
  - Reviewing the customer journey;
  - Carrying out a Rapid Enterprise Assessment;
  - How to embed resilience through Change Management.

The toolkits were made available to participating sites via the Insight online platform (see Resources for link).

Partner Dynamics

Prior to embarking on the Insight Project, Black Radley had worked with the Ryan O'Neill Partnership on various IT projects, including open source Project Development Toolkits for Museums aimed at increasing enterprise activity, aiding decision making and clarifying strategic intent, and software for use by Local Authorities to aid decision making around equality issues.

Having formed a robust working relationship with the Ryan O'Neill Partnership aided the Insight project greatly. The partnership was aware from previous software builds that in many cases the extent to which troubleshooting would be required was fundamentally unforeseeable, hence the allocation of a large contingency resource in the budget. Black Radley and the Ryan O'Neill partnership had also developed strong lines of communication which proved to be a significant attribute to the Insight Project. Regular remote and face to face meetings were a key feature of the relationship, as was establishing an effective interface between the participants and the technology developer; it was agreed that Black Radley should be the first point of contact to deal with enquiries as often technical difficulties follow similar themes:

- Technical incompatibility with software at the participant organisation;
- Participant uncertainty about how to use software;
- Software error.

An FAQ protocol was developed enabling Black Radley to troubleshoot the majority of issues allowing the Ryan O'Neill Partnership to continue with interface development without disturbance unless the technical difficulty could not be easily resolved.

Having established this interface between the Ryan O'Neill partnership and Black Radley, the working dynamic enabled effective delivery of the project and swift resolutions to the majority of technical issues.

Neither Black Radley nor the Ryan O'Neill Partnership had worked with Bath Spa University before and also had limited experience in partnering with academic institutions on complex IT projects. A process of 'trial and error' learning in terms of establishing an effective project interface was honed during the lifetime of the project. The primary learning point for Black Radley, as project managers, was gaining an understanding of the competing workloads and schedules in an academic environment in terms of the impact on availability of resource for the project. The resultant learning enabled Black Radley to adapt their project management style in terms of task allocation and communication scheduling to reflect the demands of University course delivery.

A strong and reliable interface was soon established between Bath Spa University and Black Radley which was helpful when the changing demands of the project required a redistribution of funds away from research analysis (Bath Spa University) and in favour of participant signup (Black Radley) and software delivery (Ryan O'Neill Partnership).

All partners are actively collaborating on pursing new projects.

Roles and Resources

Initially the roles of the project were allocated as follows:

Milestone	Key Tasks	Responsibility
Project Infrastructure	Contracting Budgeting Planning	All BR / ROP BR / ROP
Milestone 2: Research & Recruitment	Literature Review / Background Research Sector Questionnaires Participant Recruitment Interface Design	BSU BSU/BR BR ROP
Milestone 3: Initial Research Reporting	Background research analysis Continued Participant Recruitment Interface refinement	BSU / BR BR ROP
Milestone 4: Data Collection Interface	Closed Usability trials Public Usability trials	ROP / BR ROP / BR
Milestone 5: Launch of Data Collection Interface	Design of business analysis toolkit Primary data analysis Quarterly Project Review Data Chasing / Troubleshooting	BR BR / BSU All BR / ROP
Milestone 6: Regression Analysis	Identify and analyse statistically significant relationships Internal report and findings analysis	ROP / BSU All
Milestone 7: Reporting Interface	Launch of results reporting interface Launch of toolkits Internal recommendations reporting	ROP / BR ROP / BR BR / BSU
Milestone 8: Final Report	Delivery of final report Findings dissemination	All All

Largely the key tasks remained unchanged, however, the budget had to be responsive to a variety of shifting contextual factors, including adapting to a previously untried collaboration with an academic institution, responding to unexpected technical challenges when building the online platform, and in particular responding to the low participation and data submission rates.

Results

Overall Outcome

The Insight project can be deemed a success in so far as the Project Partners were able to build software that predicts museum performance across key parameters and can provide analysis that enables participating museums to understand their income generating potential as indicated by the target income ranges established across key criteria by data from other participating sites.

The target income ranges are responsive to each new data set added, and therefore will always be changing, enabling organisations to see shifts in the marketplace as defined by the successes or challenges of their comparators almost in real time.

The results so far generated, however, whilst having a degree of utility to the sector would be strengthened were more museums to participate in entering their data; in terms of participation, the project can be deemed as a moderate success in so far as enough data was provided to be statistically significant, but insufficient as far as enabling the Project Partners access to enough data to undertake a rigorous analysis and achieve a comprehensive understanding of why the relationships between factors were significant.

The most interesting findings, however, were those which the project had not initially sought to investigate; findings which relate to organisational efficiencies as oppose to activities and offer. This line of investigation only became apparent as the project partners encountered barriers to participation and data-entry far in excess of what had been anticipated at the outset.

If, over the next year, more participants (and therefore data) can be added to the interface, participating museums would be able to access a more advanced understanding of the factors that play the biggest role in determining commercial income. This would ensure a greater state of readiness to face funding challenges.

Results Breakdown

Participation

As mentioned, over 800 approaches were made to Local Authorities, individual sites, and development and membership organisations. Publicity for the programme also appeared in trade publications and messaging was distributed via funders. Over the course of six months, nearly 200 museums joined the project. Of the museums which joined the project 96 began entering data but by August 2015 only 62 museums were able to provide information covering 12 months of museum performance. Of the 34 museums which began entering data but did not enter sufficient data, the majority (70%) did not provide any monthly data.

Although the project was not able to achieve its target number of 200 participant museums, each entering 12 months' worth of data, the data gathered represents 744 months of commercial performance information which has allowed the team to provide an analysis.

The project partners have been able to show that the technology works, however there are underlining issues that need to be addressed before more robust analyses can be made. This is discussed in greater detail below.

User profile

Of the 62 museums that were able to provide a full 12 months' worth of data, the busiest had 570,000 visitors in the 12 months studied, whilst the quietest had only 320 visitors. The average site had 105,000 visitors.

The sites also covered a range of physical sizes, from 20 to 10,000 square metres of indoor area. The average indoor area was 2,900 square metres (about half the size of a football pitch).

The map shows that the museums are mainly located in England and Wales, with only one site in Scotland. This was a deliberate choice to focus on England and Wales since census data at a ward and local authority level is not as readily available for Scotland, as it is for England and Wales. At this stage the study is also deliberately focused on provincial museums rather than those in the capital and this is apparent from the map.

Figure 2 Participant geographic distribution

Regression Analysis

The goal of this study is to identify factors which influence museum commercial performance and to use those factors to project performance for individual museums. Ordinary least squares regression analysis was used determine which factors significantly affect museum performance. The focus of regression analysis is on the relationship between a dependent variable (such as, for example, visitor numbers) and one or more explanatory variables (such as, for example, where a respondent identifies as a museum or a castle, or has or does not have a shop). Regression analysis helps us understand how the typical value of the dependent variable changes when any one of the explanatory variables changes.

A basic formula is applied to determine the change in the dependent variable, for example:

$$Y = f(X_1 + X_2 + X_3)$$

The dependent variable (Y) is considered to be a function (f) of the independent variables (X). The regression analysis provides the coefficients for the X values in this linear equation, together with their level of statistical significance. The coefficients allow us to determine how large an affect the explanatory variables have on the dependent variable. This approach is ideal if there is an approximately linear relationship between the explanatory

and dependent variables. Early in the analysis it was observed that all the relationships were highly skewed. For example many of the sites showed low visitor numbers and incomes per visitor. A typical approach to skewed data is to use a log transformation to allow the modelling to be more successful. So the equation modelled takes this form:

$$Log(Y) = f(X_1 + X_2 + X_3)$$

Under these circumstances, the elements are no longer directly additive and are therefore harder to interpret since the estimate of Y now follows this equation.

$$Y = e^{X_1+X_2+X_3}$$

Hence, for convenience the project partners have adopted a system of coding to standardise the size of the effect of the coefficients, as follows (Please see Appendix 1 for actual regression analysis breakdown):

Symbol	Meaning
+++	Very Strong Positive Effect
++	Strong Positive Effect
+	Positive Effect
-	Negative Effect
--	Strong Negative Effect
---	Very Strong Negative Effect

These techniques have then been used to project museum performance in three example cases, Museum A (a small museum in London, Museum B (a large museum in the Midlands) and Museum C (a small museum in the North West) to demonstrate how the projections behave. In each case, the museum is presented with a graph that shows 3 lines:

- The actual level of visitor numbers or income as originally entered in to the interface.
- The projected/expected level of visitor numbers/income based on comparisons with similar sites (as defined by how each site characterised itself when initially signing up for the trial).
- The 'Upper Projected' level of income the site could anticipate to see if it was performing as the best of a similar site

The example cases have been anonymised.

Influencing Factors on Visitor Numbers

Total visitor numbers are often used to make comparisons between museums. Whilst the discussion of visitor numbers provides some healthy competition between museum managers, a direct comparison is not useful since it ignores the circumstances of each museum. The analysis indicates that 7 factors in the data set have a significant influence on the number of visitors a museum receives.

++ Identifies itself as a museum: It is a little surprising that whether or not the site in question was a museum is significant. Only 38 of the 62 sites identified themselves as having a museum and the presence of an explicitly named museum had a positive effect on visitor numbers (alternative forms of identification offered included 'Historic House', 'Country Park', 'Castle', 'Gallery', etc.)

++ Is a castle: Sites which identified themselves has having a castle were consistently able to attract more visitors. There are only 2 in the data set, so one might be naturally suspicious of this finding. However, the museums submitted 24 months of data and the finding was statistically significant at a 99% confidence interval. Presence of a castle has a strong influence on visitor numbers.

+ Provide refreshment: The presence of refreshments has a positive effect on visitor numbers.

Month: Visitor numbers typically vary throughout the year showing peaks which coincide with school Spring and Summer holidays with a dip at Christmas. The analysis did attempt to partition the months into holidays and not holidays but the month in the year provided the best projection (see Appendix 1).

+ Indoor area: A larger indoor area is associated with higher visitor numbers. One might surmise that larger museums do attract more visitors. However it would be possible to make a case for the prospect that museums that get more visitors grow larger.

--- Has a website: The presence of a website negatively affects the number of visitors and badly. Inspecting the data directly, it appears

that the larger more successful museums have not provided a website address despite in fact having one. This is undoubtedly an artefact resulting from the differences in the behaviour of staff in larger and smaller organisations rather than the effect of not having a website.

What is of interest is the consistency of this behaviour. This finding may naturally lead to speculation as to the validity of the other datasets, however it is important to note that a) the remaining results do not appear to be incongruent with what may be expected, b) the model is designed to deal with inconsistencies in the dataset (i.e., reduce 'noise') and c) further investigation is required to ascertain the drivers of participant behaviour when submitting data to the Insight platform, for example, was filling in the website field deemed 'less important' than filling in visitor numbers or perhaps was there an organisational misunderstanding of 'field ownership' (who is responsible for filling in which sections).

It is interesting to note that factors concerning the area around the museums appear not to be significant based on the data gathered (e.g. population density or social grade of residents). It is probably unwise to read too much into this, whilst it is possible to determine which factors are significant, the absence of significance does not necessarily prove the absence of an effect.

The significant factors identified in the analysis can be used to project the expected visitor numbers through the year for individual sites, based on the machine learning algorithm. The graph of visitor numbers for Museum A shows the actual, projected and upper projected levels of visitor numbers.

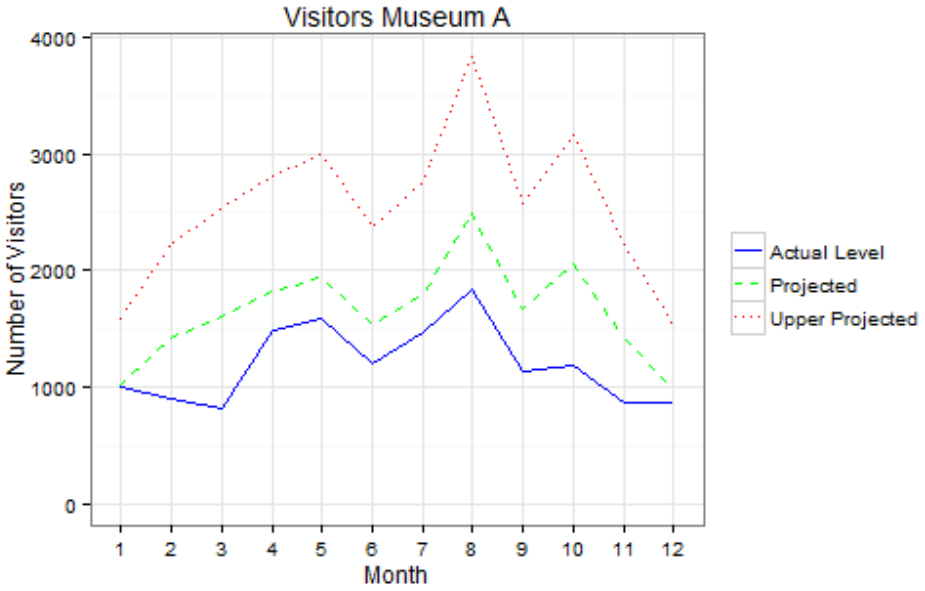

Figure 3 Visitor Numbers Projections, Museum A

The shape of the profile for the actual visitor numbers closely matches that of the projected levels. However, the actual level of visitor numbers are lower than projected and certainly lower than the upper projected level. The suggestion might be that there is potential for the museum to attract more visitors.

Museum B attracts many more visitors than museum A. The projected levels are also much higher since the projections are based on the features of

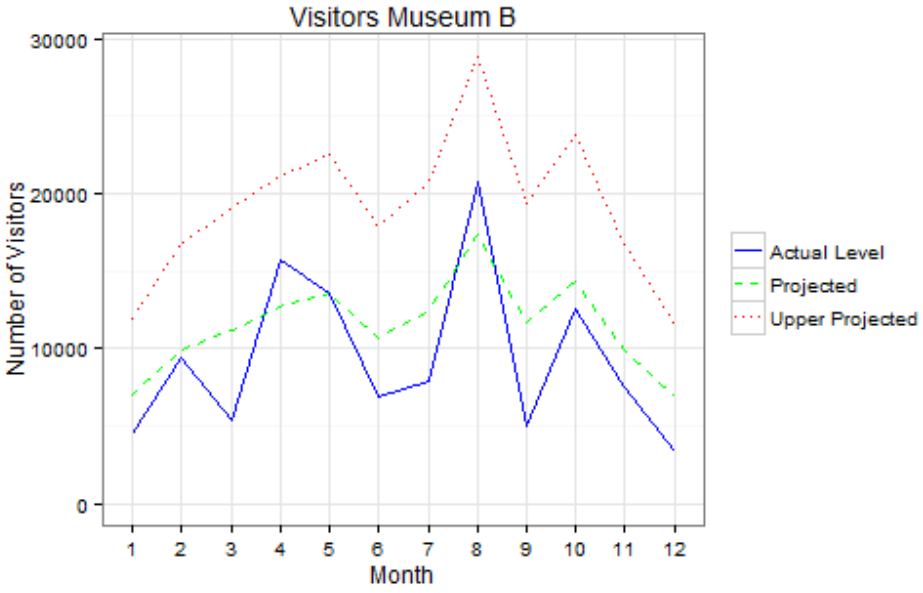

Figure 4 Visitor Numbers Projection, Museum B

museum B. The projections are demonstrably consistent with the museums actual performance. During the summer the numbers of visitors exceeds, the projected level of visitors. The upper projections are for the 95th percentile (i.e. top performing museums in this data set). This is the level that the projection expects for a museum that is performing exceptionally well when compared with its peers.

Museum C appears to be doing exceptionally well when compared to the projections, exceeding both the projected level and upper projection throughout the year. Whilst the actual levels of visitor numbers are quite low the museum appears to be far better than expected.

Influencing Factors on Admissions Income

Whilst visitor numbers have traditionally been used to compare museums they are just one aspect of museum performance. However, for museums seeking to improve income the question of charging for admission looms large. In this study 14 of the museums were charging for admission. The average admission income per visitor was £2.78. The average admission price for the top performing museum was £10.09.

At first sight admission income per visitor appears to provide a useful measure for comparing museum performance. However, it largely serves to compare museums on their admission charging policy. The goal should be for an individual museum to maximise total admission income rather than income per visitor (i.e. greater revenues are generated by charging £2 per person for 200 visitors than £20 per person for 2 visitors). Unfortunately the situation is not quite so simple because, as we shall see, the decision to charge for admission also affects retail income.

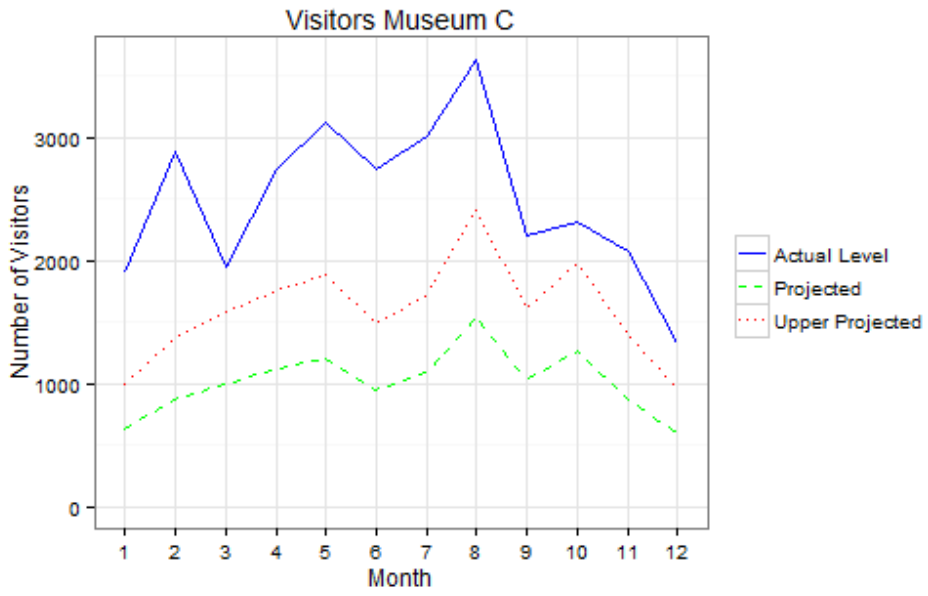

Figure 5 Visitor Number Projections, Museum C

+++ Visitors per month: Perhaps unsurprisingly visitor numbers are an important determinant for total admission income.

+++ Provides refreshment: Again the provision of refreshments appears to be an important factor which positively affects museum

income. In all but 3 of the participating museums the refreshments were outside the pay barrier (admissions desk). It appears that having refreshments before the (paid) admissions desk has a positive effect on museum income. Since so few of the museums had refreshments after a pay barrier it is not possible to determine what the effect would be of enclosing refreshments within the pay barrier.

+++ Ward population density: Resident population density with the ward where the museum is located (taken from the 2011 UK Census) has a positive effect on museum income. Where the population density is higher so is museum income. Whilst this factor is significant it was suggested during the analysis that crime levels might be a more effective proxy for 'urban-ness' in that reported crime (particularly anti-social behaviour) reflects where people interact rather than where they live. Never-the-less, residential population density remains a more effective predictor for museum income than reported crime.

++ Indoor area: Size matters, museums with a larger indoor area gather more income than those with a smaller indoor area. There is only a weak correlation between area and visitor numbers so it is not likely that museums with a larger indoor area are getting more visitors. It is more likely that museums with a larger indoor area have a different approach to admissions charges than those with a smaller indoor area.

+ Marketing effort: The number of hours spent on marketing that month is a useful measure for projecting a museums income for that month. Unfortunately there was insufficient data to determine if there is a relationship between the type or configuration of a museum and the level of marketing effort.

+ Ward social grade C2: Another significant (and yet curious factor) is the presence of a high proportion of skilled manual occupations resident in the local area. Quite why this may be is not obvious and it is not possible to determine if members of those occupations are visiting the museums or just like to live in areas with museums. The data collected did not include social grade of the visitors so it is not possible to determine if there is a correlation between the residents of the local area and the visitors.

In comparing the actual values with the projected values for the three example museums, it is apparent that the projections have some limitations, mainly surrounding the influence of visitor numbers.

The graph of actual income for Museum A closely follows visitor numbers as you would expect with peaks matching the school holidays (refer to Visitor Numbers Projection, Museum A graph).

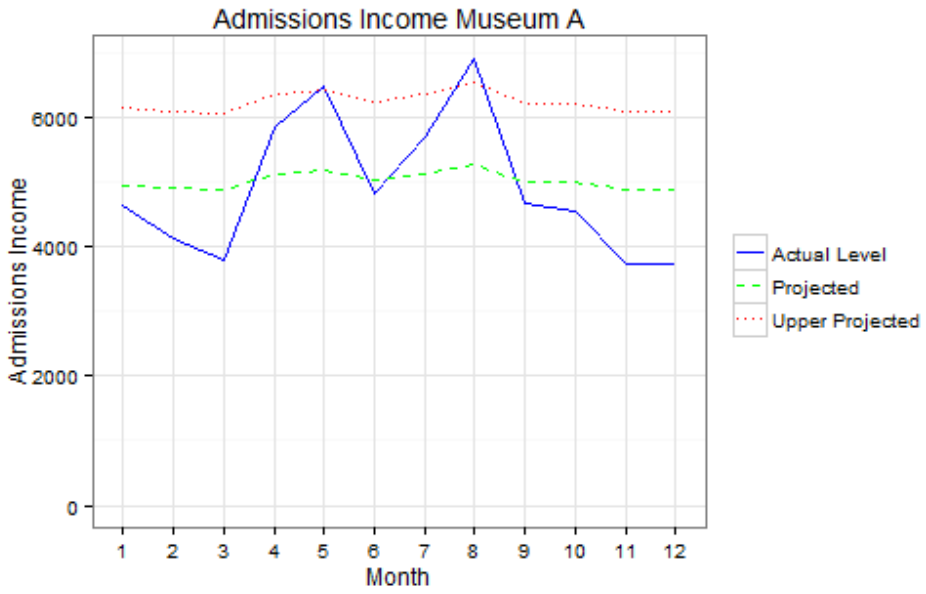

Figure 6 Admission Income Projection, Museum A

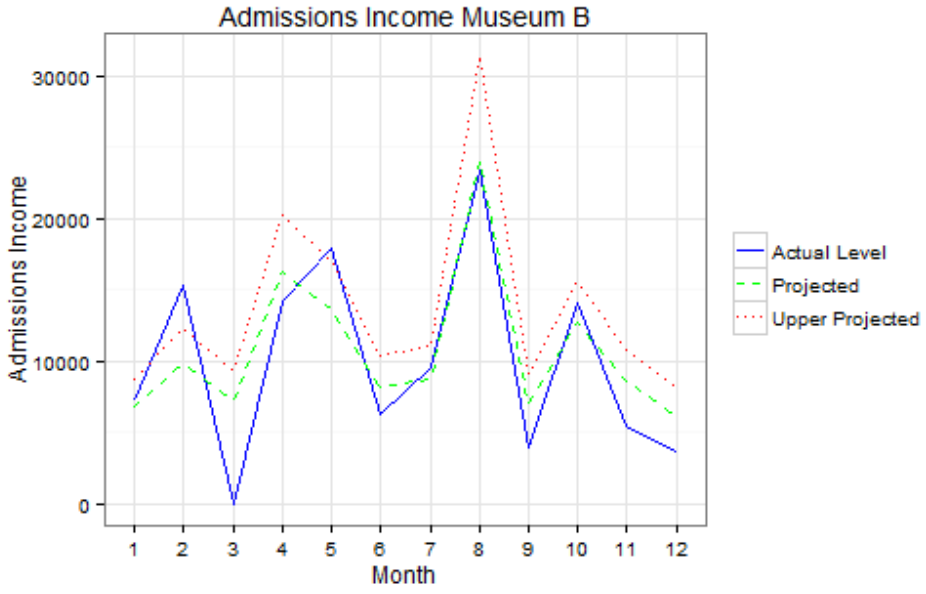

Figure 7 Admissions Income Project, Museum B

The actual income wavers around the projected level which is much more stable. The projections use visitor numbers as one factor from the six used. Where visitor numbers are low, the projections tend to under-estimate the effect of visitor numbers on income. For higher visitor numbers one would expect income to more closely follow visitor numbers.

The greater influence of high visitor numbers on income is apparent for Museum B which receives 5 times as many visitors as Museum A.

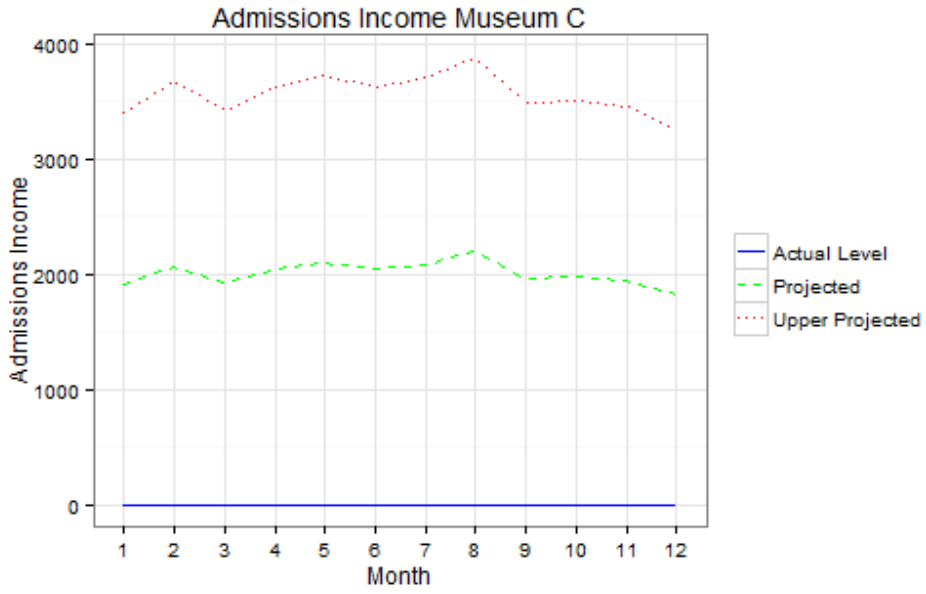

Figure 8 Admissions Income Projection, Museum C

Museum C does not charge for admission so the actual income is zero. The projected and upper projected levels imply that monthly income could be in the region of £2,000-3,000 a month if the museum began charging for admission. However, one could not expect the visitor numbers to remain unaffected by the decision to charge. Additionally it is apparent the retail income is also affected by the decision to charge for admission.

Influencing factors on Retail Income

Of the 62 participants, 42 provide a retail offering. The range of retail spend per visitor appears to be extremely wide from 1p per visitor at one extreme

to £58.45 per visitor at the other extreme. The average is a more reasonable £1.75 per visitor, which is consistent with benchmarking guidelines. [2]

The projections depend upon 9 factors.

+++ Café income per visitor: There is an extremely strong and significant relationship between café spend and retail spend per visitor. Where spend per visitor is high in the café, it is also high in the shop.

+++ "Exit Through the Gift Shop": The projections show a strong positive effect of this customer flow device on retail income.

++ Additional events: Putting on additional events has a substantial positive effect on retail spend per visitor. The data does not allow us to determine if the spend is happening at the time of the events.

++ Identifies as a museum: The presence of, or identifying as, a museum seems also has positive effect on retail spend per visitor. It would be useful to be able to determine if the relationship between sales lines in the shop and artefacts in the museum were driving shopping behaviour. The data collected did include an opportunity to express the percentage of lines in the shop which relate to collections. Unfortunately, this data was rarely completed by participants so it could not be used in the analysis. There was also insufficient data available to determine if distance to the shop or area of the shop influences spending per visitor.

+ Pay to enter: Interestingly charging admission has a positive effect on retail income per visitor.

+ Pay to shop: Having the shop behind the pay barrier has a positive effect retail spend per visitor.

- Shop visible from entrance: Having the shop visible from the entrance actually has a negative effect on retail spend per head.

-Visitors per month: Despite the fact that the goal is to project retail income per visitor, rather than just retail income, the number of visitors has an effect. The effect is negative so museums with more visitors get a lower retail income per visitor that less busy sites.

[2] http://www.aim-museums.co.uk/downloads/629171cb-13e8-11e2-b292-001999b209eb.pdf

---Has a website: Yet again the presence of a website negatively affects the number of visitors and badly. This is likely to be a consistent reporting bias rather than a genuine effect, i.e. the majority of high-income museums neglected to fill in this field resulting in a negative effect.

The strongest relationship is between the shop and the café. Spending in the café per person correlates strongly with retail spend per person. They have a correlation of 75%. It seems that whatever is spent in the café, about two thirds of that amount will be spent again in the shop.

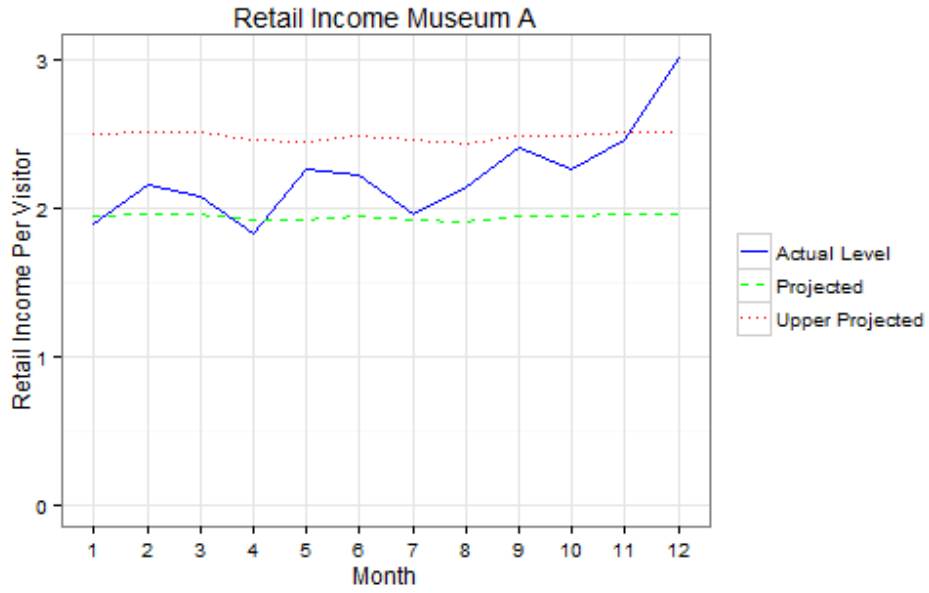

Figure 9 Retail Income Projections, Museum A

For Museum A actual spend hovers around £2, between the projected and the upper projected levels. Both the projections remain relatively flat. Whilst spend per visitor peaks in December it should be remembered that from section 2.2 that this is when visitor numbers drop to their lowest levels.

Museum B has a substantially lower spend per visitor, hovering around 30 to 40p. The projections suggest that it might be possible to increase the spending per head by a small margin. Since Museum B has large numbers of visitors a small increase in visitor spend might deliver worthwhile rewards.

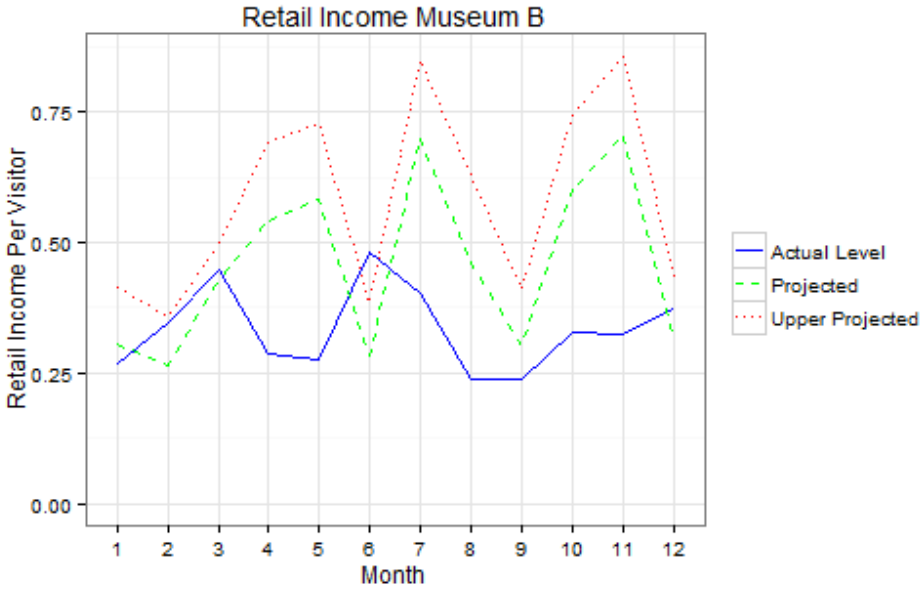

Figure 10 Retail Income Projections, Museum B

Whilst Museum C is clearly effective at bringing in visitors, the actual spend per visitor is extremely low. The projections suggest that this might be increased to about 75p per visitor.

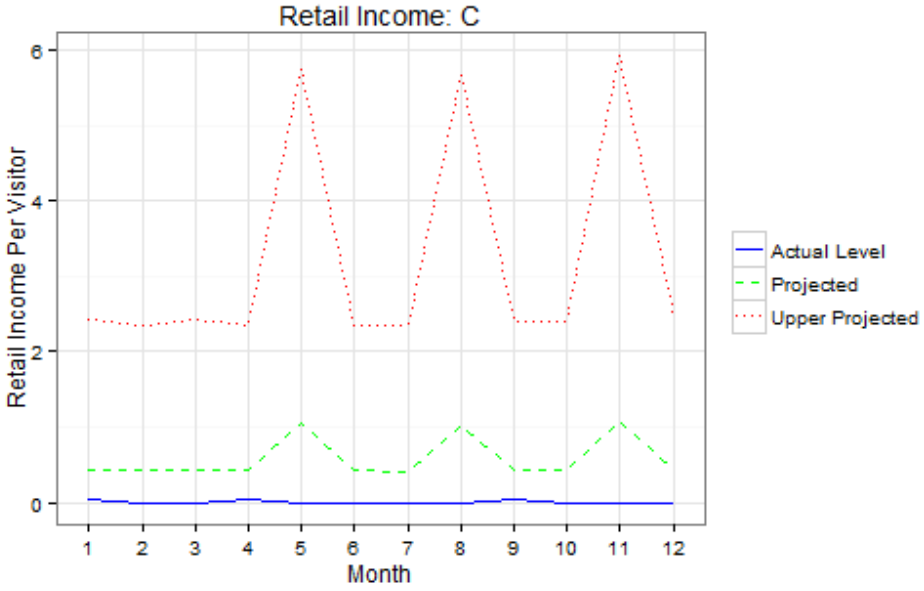

Figure 11 Retail Income Projections, Museum C

Influencing Factors on Refreshment Income

Only 20 of the museums which participated in the study provide refreshments for their visitors. The average refreshment spend per visitor is £2.93, about 50% more than is spent per visitor in the shop. Again the maximum of £61.95 and minimum of 26p appear to show that some of the data entered is in error, sometimes by orders of magnitude.

+++ Is a park: Museums which indicate as also being a country park or estate have a higher refreshment spend per visitor.

++ Full meals, vegetarian options, tea and coffee: Unsurprisingly these services or options which tend to broaden the refreshment offer substantially improve refreshment spend per visitor.

+ Retail income per visitor: The strong relationship between refreshment and retail spend allows retail spend to be used to project refreshment spend.

-- Vending machines, table service and an alcohol licence: The provision of these services has a negative effect on refreshment spend per visitor.

-- Historic house: Museums which identify has having an historic house have a significantly reduced spend on refreshments per visitor.

Unfortunately there was insufficient data to determine if other factors, such as the number of seats or distance to the café, have an effect of refreshment spending.

The projections for refreshment spend per visitor rely on many of the features associated with the refreshment service, such as full meals or table service. It is interesting to observe how the projections perform using minimal data for the three example museums only one of which has an extremely limited refreshment service.

Museum A does not provide any refreshment service but the projections indicate that it has the greatest potential. This is largely determined by the retail spend which has a strong relationship with refreshment spend per visitor.

Figure 12 Refreshment Income Projections, Museum A

Figure 13 Refreshment Income Projections, Museum B

Museum B has and extremely limited refreshment offering and as a result the level of refreshment spend per visitor is extremely low and erratic. The low retail spend also means that the projections for refreshment spend per visitor remain very low.

Figure 14 Refreshment Income Projections, Museum C

Museum C does not provide a refreshments service. Low visitor numbers suggest that it would not be financially viable to introduce a refreshment service.

Barriers to data entry

Following the recognition that a change in direction of the research was necessary to understand barriers to data entry, Bath Spa University conducted research in to the systems used to gain entry to the Insight interface using Google Analytics.

Despite the provision of a mobile interface very few of the users made use of it. The overwhelming number of museums used a conventional Windows PC to enter data. This is not surprising given that many museums are or have been under local authority control and as a result make use of a very conventional IT infrastructure which probably does not provide for mobile

devices. As you can see, only a small percentage of participants utilised mobile technology to enter their data (iOS, Android).

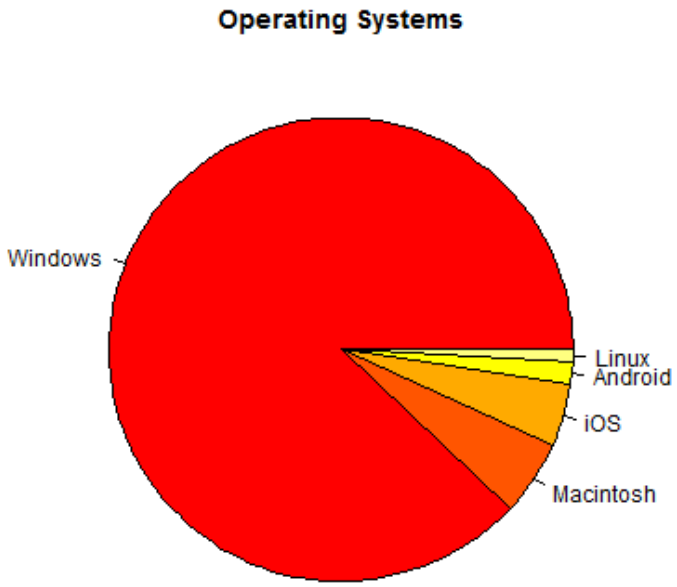

Figure 15 Operating System usage

What is more surprising is the number of museums which are using Windows XP. Support for Windows XP ended in April 2014 after a long (and repeatedly extended) period of warning. Whilst the proportion of Windows XP users is not great in itself, its very presence is a cause for concern and indicates a greater than expected proportion of the sector operating below the technical standards which contemporary commercial practice requires.

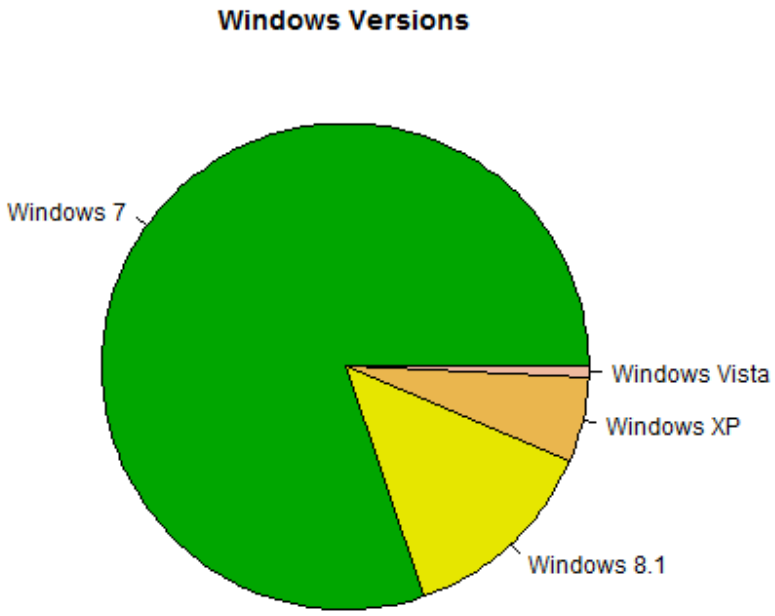

Figure 16 Windows Version distribution

Reflecting the preponderance of Windows use, the majority of users used Internet Explorer as their browser. This is not atypical for risk averse corporate environments, where browsers are updated cautiously and there is little experimentation with alternative browser types.

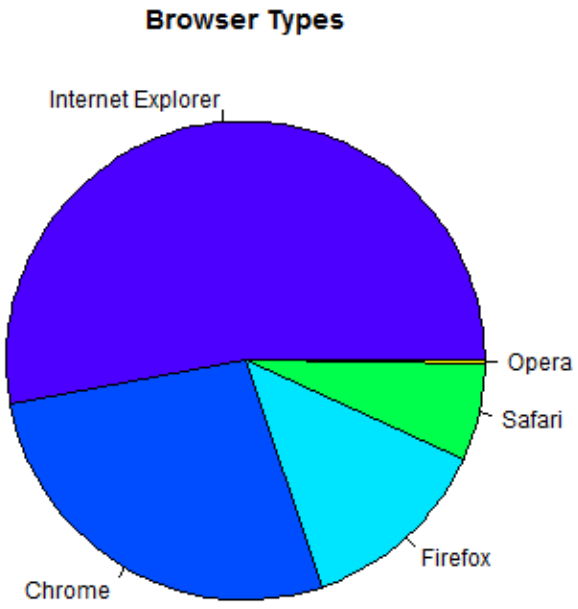

Figure 17 Internet Browser Usage

Again consistent with a conservative approach to maintaining and updating IT infrastructure there is a tendency towards older versions of the Internet Explorer browser. At the end of 2015 only Internet Explorer 11 will continue to be supported.

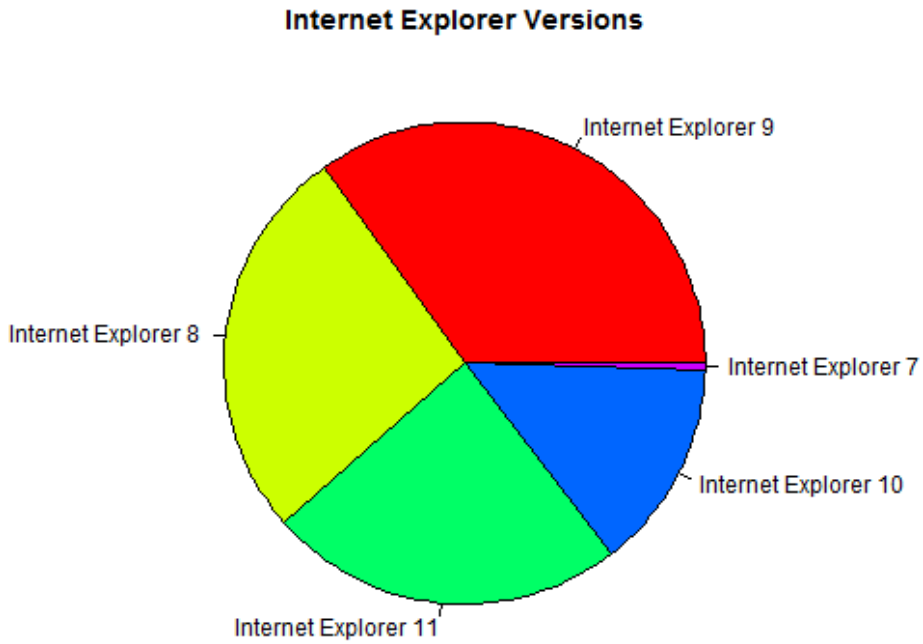

Figure 18 Internet Explorer Distribution

Not all museums are utilising what may be considered as inefficient technology, however overall the results indicate that the sector has a conservative approach to IT infrastructure in terms of maintenance and upgrades. Inevitably this has a knock-on effect for museums adding data, and may be an indicator of the likely efficiency of internal processes.

IT Challenges

In view of the impression gained from the Google Analytics data about IT infrastructure it is not a surprise to that some of the museums involved had issues with entering data. The interface was designed to work with all browsers starting with Internet Explorer 8. Supporting older browsers represents a considerable cost in extra development time and represents only a small section of the potential users.

Approximately 10% of the users had some challenge directly related to IT infrastructure which was outside of their control and outside of the projects

control. Typically this related to security access via their firewall or an in ability to accept an SSL (Secure Sockets Layer) connection. In all but one case, these issues were resolved either by local IT departments or by the project team providing a less secure interface without SSL.

Data Availability Challenges

The remaining feedback related to the availability and provision of data. About 10% of users required further support with understanding the data required. In most cases, this could be resolved with reference to the help and support text which was already available. Not unusually, most users do not read the help text. Whilst this is entirely normal it necessarily leads to inconsistencies in the data gathered. It was expected that these inconsistencies would remain reasonable and would not adversely affect any analysis designed to handle small variations.

Approximately two thirds of the museums which signed up to take part in the study were unable to provide data covering 12 months. These museums were contacted directly to determine the reason for not continuing with the study. The majority of museums cited lack of resources and lack of availability of data preventing their continued participation. It was also evident from discussions with these museums that whilst much of the data is present within the organisation, organisational challenges mean that it is not readily available. For many of the museums which did take part the data was not provided by one member of staff, but the form was passed around between multiple members of staff within the organisation. It is therefore clear that for many museums commercial data is siloed between departments.

Findings interpretation

This analysis is based upon the data which was gathered in April, May and June 2015. All the errors and limitations were maintained in their unaltered state. These constraints have themselves proved enlightening.

The dataset was explicitly intended to focus on provincial museums (i.e. outside National Museums), which experience many of the same challenges existing outside the ‘London bubble’. What was not expected was that these ‘challenges’ can, in part, be described as access to (and capacity to input) meaningful data.

In attempting to interpret the results, many conclusions can be drawn, and many speculations can be made as to why the Insight project received the results it did. In attempting to shed light on this, the steering committee was asked to share its perspectives, a selection of comments are detailed below:

Data Contribution

"I am not surprised by the levels of contribution from the sector towards the study. I guess for some very small museums it's comparatively easy as everything they have is in one place! For us it is certainly true that a few different people needed to provide info - especially given that we operate 9 different sites some up to 7 or 8 miles apart."

"Absolutely standard that these things take a while. A year to do a benchmarking sounds like a while, but is never long enough once recruitment and analysis time are factored in."

"The scepticism [towards data entry] worries me and has, in my opinion, two causes:

1. A genuine increase in level of "competition" in the insight/data analysis tools/consultancy sector after a period of consolidation post the loss of the core funded bodies and quangos (MLA, regional Audience Development agencies etc.);
2. A misunderstanding of the differences and benefits of the different schemes.

Therefore I think it is really important that we, as collaborators in the same market, and our funders, improve our communication around what we do differently and how it benefits orgs to be part of different schemes. It also means we need to improve standardisation and interoperability which is talked about but we've not done yet and would ideally require some investment and policy leadership from [major funders]."

"The issues related to data collection/data accuracy and IT infrastructure are very interesting. There are some hints in the report on how 'direction' of bias in the data may be related to the type and size of the reporting organisation. Any further elaboration on this would be massively useful for anyone willing to do a data-related

project in any arts organisation and could be helpful in the general discussion about data quality in the sector."

"As for the difficulties of collecting data, it does seem a real problem that does not seem to be soluble by making it easy for sites to respond to questionnaires online. Ultimately I believe we shall need to seriously incentivise sites to record and report data, probably with a significant fee. That way a more robust and representative sample set could be obtained, and the more difficult questions answered. e.g. distance to shop etc."

Technology

"Recognising the existing data, data skills and need for those skills more widely is hugely important… [E]ven access to systems and data i.e. the Information Management Systems are limited in even the largest organisations because it may not yet be seen as core to the business of being a cultural organisations."

General

"From my experience Local Authority museums often do not have responsibility to control the content on websites if they do not have distinct URL."

"I think there are some interesting conclusions and I'm sure museums would find it very helpful to project income and learn from peaks in business. It would be interesting to understand how the spend per head varies more on the type of visitor and their motivation to visit i.e. I'd like to understand the difference between a family attraction and perhaps a more specialist museum which may attract smaller visitor numbers. I wonder about the impact of special exhibitions which may attract new visitors. Another variable may be if a museum is located within a tourism area – and in fact visitors are on their holidays so are likely to spend more."

"The interesting and complex questions [you asked] about charging, covered experiences, retail 'theming', and location of retail and catering etc. cannot be answered with the data supplied. It feels to me that a much bigger and more costly study is necessary."

Whilst further data would add weight to the study, and refine the conclusions, there is little reason to expect results which contradict the current findings given the range of participating sites. However, what is needed is a robust method of collecting the data participating sites were unable to provide for Insight, without which deeper analysis and clear understanding of the drivers of commercial performance in a museum setting is simply not possible.

To achieve this, significant steps must be taken to tackle the difficulties within the sector relating to data collection and interpretation, including:

- Altering perceptions of its importance and therefore prominence as a key means of improving commercial performance and indeed core delivery;
- Defining processes which enable effective inter-departmental transference and use of data.

Case Studies

Introduction

The purpose of these case studies is to explore how the Insight findings are received in the sector, how much they align with problems faced on the front line, and how they may inform development of processes and decision making relating to data collection and use. The case studies explore a museum in Yorkshire and an art gallery in Tyne & Wear.

The Context

Insight and the Visitor Cycle

The Insight platform was designed to measure key factors of the 'visitor cycle':

- Attention: The means by which a museum or heritage attraction gains the attention of a potential visitor;
- Planning: The ease of which a potential visitor can plan their visit;
- Travelling & Arrival: How easy it is to get to the location, and a visitors first impressions when they arrive;
- Site Proposition: The clarity of the overall offer and the coherence with which it is executed, including:
    - Collections and Interpretation;
    - Retail offer;
    - Catering offer.

Insight Findings

The Insight trial revealed that nationwide, the most influential determinates of commercial performance were:

- Visitor Numbers;
- Admissions Charges;
- Retail Offer;
- Catering Offer.

However, whilst in the process of gathering data for the trial, the project partners were able to collect additional information which provided added context to the results; for example a number of participating sites:

- Regularly use out of date technology (such as computer systems and internet browsers);
- Stated that they did not have (or did not have access to) the information requested as part of the trial;
- Stated that they did not have capacity to input sufficient data, and therefore only partially filled out the forms.

Sector Support

Given the difficulty in obtaining the breadth of data the project partners asked of the sector it was suggested that part of Insight's remit should be expanded to include enhancing data best practice. This work would have a direct impact on commercial performance although the work should also take in to account the factors which underpin this activity, i.e. overall organisational health.

In light of this, the project partners developed four toolkits, based on Black Radley methodology, exploring the four pillars of organisational health:

- Organisational fitness;
- Organisational flexibility;
- Organisational strategy;
- Organisational change.

These toolkits gave an overview of the theory behind the methodology and set out a variety of practical activities targeted to identify and address any organisational weakness.

Museum 1: Yorkshire

Museum 1 is a Georgian country house, set in historic parkland in Yorkshire. It attracts over 130,000 visitors per year. It does not currently have a catering offer, however it does run a retail function. The team at Museum 1, like many in the country, are currently exploring how to increase commercial performance.

To inform this case study, and add context to the Insight findings, a separate review of the strengths and opportunities of the site was undertaken. This review was based on key components of the visitor journey, and its purpose was to understand what elements of the site were either encouraging or hampering visitor spend. The findings were as follows:

Strengths

- Lack of competing Georgian houses in the area;
- High footfall on estate and neighbouring attraction;
- Rich history from which to draw the proposition;
- Close proximity to metropolitan areas;
- Sizable retail space (proportionally to the size of the museum);
- Available space for expanding commercial facilities;
- Strong links to the surrounding parkland;
- A large public appetite for heritage experiences.

Opportunities

- Strengthen online presence and communication of proposition;
- Make clear the distinction between the official website and enthusiast websites;
- Enhance emphasis of commercial offers online;
- Improve quantity of signage on eastern approaches to the site;
- Improve on-site directional signage to compete with nearby attraction;

- Redesign exterior of museum to align with the 'Georgian house' experience;
- Prioritise and focus the narrative of the proposition and associated interpretation;
- Enhance displays and use of collections to reflect the narrative;
- Enhance retail displays and stock choices to align with the proposition;
- Consider the addition of refreshment facilities.

Insight Findings: Admissions

Museum 1 does not currently charge admission, however based on an analysis of sites that share similar features to Museum 1, the site could expect to receive between £900 and £1,400 per month, at a baseline level, depending on the season. However, if the site was operating at peak performance, it could expect to receive between £1,900 and £3,400 per month.

Insight Findings: Refreshment

Museum 1 does not current offer visitor refreshments. However, the analysis of comparable sites shows that at a baseline level, Museum 1 could expect to make around 29p per visitor. If the site was operating at peak performance, this figure increases to around 99p per visitor. Therefore, assuming they continue on the trend of around 130,000 visitors per annum, they could expect to make a gross refreshment income of £128,700 per year.

Insight Findings: Retail

The retail offer at Museum 1 peaked at an average income of 55p per visitor in the first month of the data set provided. This declined over the following months, eventually stabilising at around 20p per visitor for the final two-thirds of the year. The projections show that Museum 1 is slightly underperforming, as the baseline retail spend for a museum with Museum 1's characteristics is around 23p per visitor, which increases to around 90p per visitor for a site operating at peak performance.

Insight Findings: Visitor Numbers

In terms of visitor numbers, Museum 1 is operating comfortably above the baseline projection, and only slightly below the upper projection. Given this high performance, there is a great deal of scope to increase income by improving spend per head.

Recommendations

For a site that achieves such high visitor numbers, the retail offer is significantly underperforming. Museum 1 should focus on understanding the reasons behind this and making progress in this area. Whilst the Insight findings can identify areas of underperformance, the reasons behind it can only be known 'on the ground'. Utilising the toolkit methodology it is crucial for Museum 1 to gain an understanding of its organisation fitness, flexibility and strategic intent, identify weaknesses and set about identifying key points of focus around which change is necessary.

Managers' Response

> "I found the Insight read-outs interesting and very useful. I was surprised that the potential from charging admission was so low and certainly not the panacea that is often suggested. The potential of the refreshment offer confirmed our assumptions around the potential for this not only in commercial terms but as a key part of the proposition – at the moment it's something that is glaringly missing from the visitor experience. I'm interested in exploring the different operating models for catering– running in house or tenancy in order to maximise as an income generator for us. The upper projection for retail is very encouraging, and again confirms our gut-reaction that this is key area of focus moving forward.
>
> The main thing I have taken from this is the need to focus and be clear about our vision, who we are aiming our business at and what our proposition is. It is clear that there are key areas for us to grow and be more enterprising – primarily retail and refreshment offer, especially given our visitor numbers. Retail we believe is our top area of focus going forward not only at this site, but across our service. The need for a robust business plan will also be key – not the type of plans we have produced in the past – with a clear financial model its heart.

> The toolkits are very useful and encouraging – they have re-enforced that commercial growth is possible even within the operating constraints of a local authority but that organisational change, responsiveness and flexibility is key to success."

Museum 2: Tyne & Wear

Museum 2 is an art gallery in Tyne & Wear. The collection primarily consists of paintings from the 18th and 19th centuries including a variety of seminal works and works by local artists. The museum is located in an urban area, has a strong retail offer including specialist lines, as well as a refreshment offer.

As with Museum 1, a separate review of the strengths and opportunities of the site was undertaken. This review was based on key components of the visitor journey, and its purpose was to understand what elements of the site were either encouraging or hampering visitor spend. The findings were as follows:

Strengths

- City Centre location provides convenience for visitors and a high foot fall;
- A good retail offer at front of the building with specialist lines;
- Free to enter, but with paid for special exhibitions;
- Good refreshment offer integrated in the museum;
- The art extends into to public space outside the gallery blurring the division between the two;
- Comprehensive signage for visitors coming from the city centre (West);
- Excellent venue for weddings and events.

Opportunities

- Improve quantity of signage on eastern approaches to the site;
- Extend the cafe and/or shop outdoors in the summer months.

Insight Findings: General

When analysing the data for Museum 2, it was found that no data was available across the four parameters of Admissions, Refreshment, Retail and Visitor Numbers. It was known, however, that although Museum 2 did not charge for admission, it did have retail and refreshment components and, of course, visitors. The site was contacted directly to establish whether they needed additional assistance to enter data across these parameters and it was discovered that they had indeed entered data for these parameters, yet this data had failed to be 'picked up' by the online reporting component of the platform.

This is indicative of one of the IT incompatibilities encountered during the life of this project; one which has proved to be problematic to resolve. At the time of writing this report, efforts were ongoing to resolve this issue.

However, it is still possible to project the likely performance of this museum based on the wider data set, as follows.

Insight Findings: Admissions

Museum 2 does not currently charge for admission, however based on an analysis of sites that share similar features to Museum 2, the site could expect to receive between £10,000 and £15,000 per month, at a baseline level, depending on the season. However, if the site was operating at peak performance, it could expect to receive between £22,000 and £42,000 per month.

Insight Findings: Refreshment

Refreshment income data was unavailable, however based on sites that share similar features to Museum 2, the site could expect to receive 25p per head at a baseline level, increasing to £1.02 per head if they were operating at peak performance.

Insight Findings: Retail

Retail income data was unavailable, however based on sites that share similar features to Museum 2, the site could expect to receive 15p per head, increasing to between 70p and 80p per head if they were operating at peak performance.

Insight Findings: Visitor Numbers

The projected levels for visitor numbers for a site that share similar features to Museum 2 are between 1,000 and 2,000 per month at a baseline level. This increases to between 5,000 and 12,000 based on the model of comparable sites. Museum 2 actually attracts between 15,000 and 21,000 visitors per month, indicating it is operating comfortably above comparable sites.

Recommendations

It is difficult to make recommendations without access to key performance data relating to retail and refreshment. It is interesting to note that both Retail and Refreshment projections for Museum 2 are markedly below that of external studies, which usually place a national average per head spend of between £1.00 and £2.00. Further research is required to understand the factors creating these differences.

In this case we know that IT incompatibility is the cause for some key data fields being unavailable, and at the time of writing this report it is unclear where the fault lies. However, in the majority of cases where IT incompatibility has been a challenge, the primary recommendation is for organisations to invest in a process of upgrading systems. This of course is not so simple in practice as the additional resource required for these upgrades and the capacity required for the associated staff training are out of reach for many museums. In cases such as these, more radical options many need to be explored, such as improving service efficiencies and economies of scale by embarking on closer working relationships with other museums allowing back office functions to be shared.

As the nature of IT incompatibility for Museum 2 has yet to be identified, the project partners asked the Chief Executive to reflect on the findings of use of technology more widely, as follows.

Chief Executives Response

> “The findings with regard to use of technology in the sector don't surprise me. Local authority departments like to minimise the number of 'migrations' so may be 'behind the curve' at any one point. They also do not tend to be 'early adopters'. Voluntary museums often only get technology upgraded when a member of

the management committee passes on their old machine, again I've seen this happen on numerous occasions."

Insights

Participation Challenge

In order to provide a sufficient data set, it was the project's target to recruit 200 museums, galleries and heritage sites to take part in the Insight trial. This took much longer than expected, and involved a far more 'hands on' approach than the project partners realised.

There were a number of factors at play. It was decided that the Museums were recruited in advance of the Insight platform being ready to receive data, so that the project partners could effectively gage the need for such a tool within the sector. However, the project partners found that sites were (understandably) unsure about signing up to something that wasn't currently viewable. It became a catch-22 situation – what was more important, ensuring there was the need, or recruiting a useful data sample? There was no right answer. In order to navigate the trepidation, the project partners invested time in contacting sites directly to explain the project in further detail, answer their questions, and clear up any doubts. This was an eye opening experience, as the project partners came to understand that each site was unique, faced its own unique set of challenges, and had its own unique needs. The project partners were able to start to identify the *character* of the sites the project partners were in contact with as if they were a living creature.

Aside from the obvious negative impacts on the timeframe, the extra time required to recruit comes with many advantages. The project partners have been able to interact with users in a more meaningful way, gain a deeper understanding of their needs, and refine the project approach. By facing the challenges of having to navigate the catch-22 situation, where there was no right answer, the project partners were forced adapt in a way that has added immense value to project; for us as sector professionals, and hopefully the users themselves.

In retrospect, the level of resource allotted to cultivate participants, chase data, and support users was underestimated. The assumption that because the sector had demonstrated a desire for a commercial analysis platform that there would also be an ability to participate in its delivery proved to be

unfounded. Careful consideration as to how greater engagement could be achieved should also be considered. Ideas explored have so far included:

- Greater incentives for participants;
- 1 to 1 on-site sessions with participants to ensure data entry.

Data Project Perceptions

During the recruitment process, the project partners came to understand the cultural sector perspective on data initiatives, which is to say, there is no one perspective. The approaches to organisations to encourage participation in Insight were met with excitement, cynicism, and all perspectives in between. As a result of this the project partners, as project developers, were able to perceive the sector in a much more nuanced way than the project partners had previously.

As mentioned in the previous Insight, the recruitment process became more involved than expected. The meant having to embark on a series of telephone calls with various organisations to answer queries about the project and address concerns that the project partners hadn't anticipated. During this process the project partners experienced largely varying degrees of understanding of Big Data; the project partners spoke to people who were hugely supportive of the concept, and those who could not see an inherent value, but most tellingly, the project partners frequently came across the question "What makes *your* project different from all the other visitor analysis projects the project partners are already utilising?", the ultimate implication of this was to expose the current (and ironically) narrow scope of Big Data projects.

Many data projects operate in silos, despite obvious crossovers and synergies. Whilst Insight will deliver visitor analysis from a unique and hugely timely perspective (of commercial vitality and resilience), there is huge potential to combine these disparate projects, which will provide sites with an analysis the type of which has not been seen before. It seems that the project partners are not the only project to come to this conclusion – during the publicity for Insight, the project partners have been approached by a number of other players who share an interest in combining forces to deliver something more wide-ranging than anyone could realistically deliver alone. The idea of this may well shape Insight beyond the life of the trial.

Technology Challenges

Another important lesson the project partners learned was that relating to the use of technology in the sector. Building the Insight platform to be as 'future proof' as possible meant that the platform was not as 'past proof' as it needed to be; i.e. it had limited utility to organisations whose operating systems and internet browser had not been routinely updated.

If the project is to be developed further in the future, time spent ensuring functionality for older systems will be key to ensure reduced barriers to entry.

Shop and Admission Charging

Where the shop is behind a pay barrier (visitors have to pay to enter before they can visit the shop) retail spend per visitor is higher. This might be considered a little surprising. One might have thought that visitors who have paid to enter would be reluctant to spend more money having just paid to enter. It is hard to know why this might be the case. It could be that the pay barrier is simply acting as a filter for visitors who are more willing to spend money.

For museums seeking the maximise income this finding might indicate that the amount visitors will spend in total is not fixed. Organizations set budgets and (sometimes) stick to them but people don't. They spend in a way which is consistent with their self-image and experience. Helping visitor's value one part of the museum experience can help them value other parts of the museum experience. This may mean that the project partners need to look more closely at the usual assumption that low admission income could be compensated for by higher secondary spend.

Future

The journey of developing the Insight platform proved to be an illuminating experience for the project partners. The distinction between the desire of the sector to take part in commercially orientated data projects and the challenges that prevent them from doing so became increasingly clear as the project progressed; the main causes of non-participation being cited as lack of capacity and lack of available data.

Next Steps

The Project Partners are keen to continue working together to explore opportunities to enhance the Insight work. The form this takes is heavily dependent on how the sector responds to the participations challenges identified, and the availability of funding. The options are:

- Expanding the scope and power of the toolkits (and associated methods of deployment and implementation) to address the underlying organisational issues the study uncovered;
- Persevering with data collection activities directly with museums;
- Combining data with that of other data collections and analysis projects to add depth and robustness to the analysis, join up findings, and demonstrate the value of combining research studies to add leverage to currently independent projects.

Future Project Adjustments

Should Insight, or a similar field of study be progressed, the primary factor to consider would be the resources required to engage participants effectively. The following enhancements are suggested:

- Expanding allotted recruitment time;
- Increase of time available for data chasing;
- Increased availability of support for participants;

In the final analysis, what will work to generate successful engagement is unclear.

Future R&D Opportunities

Overwhelmingly the response to the findings has been that more research is essential in the light of the project outcome. The Insight Project Partners believe that any potential action taken or investment in activities relating to enhancing commercial performance should be a sector priority. However having overall agreement that enhancing commercial performance is a priority for the sector is not tantamount to successfully addressing the challenges the sector is facing.

In order for real progress to be made, action needs to be taken. It is the opinion of the project partners that any future projects looking in to commercial performance in museums would best serve the sector by addressing the availability and flow of data within organisations, addressing perceptions of data usage within organisations, addressing the use of technology that allows for efficient tracking and reporting of data within organisations, and achieving service efficiencies to address the lack of capacity within organisations.

Only once action is taken to address these challenges can real progress be made in understanding the factors that influence commercial success and the sector move from a state of resilience to a state of prosperity.

Further Resources

Key resources that readers can explore to find out more.

Further project information

http://insight.blackradley.com/

https://gist.github.com/joejcollins/eb9980d610b7c07875e1

https://gist.github.com/joejcollins/90285dfde136fd42837b

Tools and guidance

https://plan.io/ - online project management tool

https://github.com/ - online software development tool

Further reading

Google prediction api. https://cloud.google.com/prediction/, September 2014.

[2] Microsoft azure machine learning. http://azure.microsoft.com/en-us/services/machine-learning/, September 2014.

[3] Stephen Bailey, Peter Falconer, Malcolm Foley, Gayle McPherson, and Margaret Graham. Charging for admission to museums and galleries: Arguments and evidence. Museum Management and Curatorship, 16(4):355 369, 1997.

[4] Jos de Haan. Museum statistics and cultural policy. In 12th plenary meeting in the European Group on Museum Statistics (EGMUS): Museum Statistics and Museum Policies - New Developments, October 2010.

[5] Victoria Dickenson. The economics of museum admission charges. Curator: The Museum Journal, 36(3):220 234, 1993.

[6] M. Feldstein. The Economics of Art Museums. National Bureau of Economic Research Conference Report. University of Chicago Press, 2009.

[7] Bent Flyvbjerg. Curbing optimism bias and strategic misrepresentation in planning: Reference class forecasting in practice. European Planning Studies, 16(1):3 21, 2006.

[8] Bruno Frey. Superstar museums: An economic analysis. Journal of Cultural Economics, 22:113 125, 1998.

[9] Bruno S. Frey and Stephan Meier. The economics of museums. In Victor Ginsburgh and David Throsby, editors, Handbook of the Economics of Art and Culture. North Holland, 2006.

[10] Bruno S. Frey and Lasse Steiner. Pay as you go: A new proposal for museum pricing. CESifo Working Paper Series, (3045), May 2010.

[11] A Gilmore and R Rentschler. Changes in museum management : a custodial or marketing emphasis. Journal of management development, 21(10):745 760, 2002.

[12] Hala Hilaly and Hisham El-Shishiny. Recent advances in econometric modeling and forecasting techniques for tourism demand prediction. In INFOS2008. Faculty of Computers & Information-Cairo University, March 2008.

[13] Peter Johnson and Barry Thomas. The economics of museums: A research perspective. Journal of Cultural Economics, 22:7585, 1998.

[14] David Maddison. Causality and museum subsidies. Journal of Cultural Economics, 28(2):89 108, 2004.

[15] Carlos Santos, Maria Alberta Oliveira, and João Coelho. The budgeting of portuguese public museums: A dynamic panel data approach. In Proceedings of World Business and Economics Research Conference 2012, August 2012.

[16] Stephan F Witt and A Witt, Christine. Forecasting tourism demand: A review of empirical research. International Journal of Forecasting, 11:447 475, 1995.

Glossary

Estimated Coefficient The estimated coefficient is the value of slope calculated by the regression.

Significance Level The probability that the variable is not relevant to the model.

SSL (Secure Sockets Layer) is a standard security technology for establishing an encrypted link between a server and a client, typically a web server (website) and a browser; or a mail server and a mail client (e.g., Outlook).

Standard Error Measure of the variability in the estimate for the coefficient.

Appendices

Appendix 1: Model Results Breakdown

Model: Visitor Numbers

$$log(VisitorsTotal) \sim Month + IsMuseum + IsCastle + AreaIndoorMetres + IsWebsitePresent + IsRefreshment$$

	Estimated Coeffecient	Standard Error	Significance Level
(Intercept)	6.1062	0.4078	0.00001
Month2	0.3346	0.2917	0.25239
Month3	0.4614	0.2948	0.11878
Month4	0.5820	0.2882	0.04452
Month5	0.6495	0.2882	0.02509
Month6	0.4149	0.2882	0.15128
Month7	0.5629	0.2882	0.05193
Month8	0.8963	0.2882	0.00209
Month9	0.4963	0.2882	0.08633
Month10	0.7036	0.2882	0.01533
Month11	0.3365	0.2913	0.24907
Month12	-0.0337	0.2913	0.90808
IsMuseum	1.2167	0.1496	0.00001
IsCastle	1.8710	0.4594	0.00006
AreaIndoorMetres	0.0002	0.0000	0.00001
IsWebsitePresent	-0.9351	0.3199	0.00378
IsRefreshment	0.9860	0.1316	0.00001

Model: Admissions Income

$$\log(IncomeAdmissions) \sim VisitorsTotal + AreaIndoorMetres + WardDensity + WardApproximatedSocialGradeC2 + MarketingEffort + IsRefreshment$$

	Estimated Coeffecient	Standard Error	Significance Level
(Intercept)	2.1713	0.4185	0.00001
VisitorsTotal	0.0001	0.0000	0.00001
AreaIndoorMetres	0.0005	0.0001	0.00001
WardDensity	0.0629	0.0055	0.00001
WardApproximatedSocialGradeC2	15.2353	1.8384	0.00001
MarketingEffort	0.0028	0.0007	0.00006
IsRefreshment	0.6791	0.1699	0.00014

Model: Retail Income Per Visitor

$$log(IncomeRetailPerVisitor) \sim VisitorsTotal + IsPayToEnter + IsArtsCentre + IsMuseum + IsWebsitePresent + PayToShop + ShopVisibleFromEntrance + IncomeRefreshmentPerVisitor + IsAdditionalEvents$$

	Estimated Coeffecient	Standard Error	Significance Level
(Intercept)	-0.6020	0.3329	0.07146
VisitorsTotal	-0.0000	0.0000	0.00028
IsPayToEnter	0.5571	0.1092	0.00001
IsArtsCentre	1.5656	0.3044	0.00001
IsMuseum	0.7083	0.1185	0.00001
IsWebsitePresent	-0.8911	0.2545	0.00052
PayToShop	2.5988	0.3105	0.00001
ShopVisibleFromEntrance	-0.8132	0.1393	0.00001
IncomeRefreshmentPerVisitor	0.0969	0.0067	0.00001
IsAdditionalEvents	0.9262	0.1403	0.00001

Model: Refreshment Income Per Visitor

$$log(IncomeRefreshmentPerVisitor) \sim IsPark + IsHistoricHouse + IsWorldHeritageSite + GoogleRating + AuthorityDensity + IncomeRetailPerVisitor + IsVending + IsTableService + IsTeaAndCoffee + IsCakeAndBiscuit + IsFullMeal + IsVegetarian + IsAlcohol$$

	Estimated Coeffecient	Standard Error	Significance Level
(Intercept)	-2.1774	0.2011	0.00001
IsPark	2.5597	0.4021	0.00001
IsHistoricHouse	-0.9655	0.1715	0.00001
GoogleRating	0.1458	0.0356	0.00010
AuthorityDensity	0.0318	0.0048	0.00001
IncomeRetailPerVisitor	0.1013	0.0095	0.00001
IsVending	-0.8813	0.1705	0.00001
IsTableService	-1.1051	0.2190	0.00001
IsTeaAndCoffee	1.4980	0.3735	0.00008
IsCakeAndBiscuit	-1.1890	0.3549	0.00096
IsFullMeal	1.0119	0.1659	0.00001
IsVegetarian	1.2195	0.2256	0.00001
IsAlcohol	-0.6543	0.1464	0.00001