White Paper

White paper reviewing the critical success factors of BI & Analytics adoption in Healthcare

Based on MBA research from Henley Business School

March, 2015

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Introduction

"You can build the solution, but users will not come," Cindi Howson writes in her famous BI book, indicating that even if it is successfully implemented, a BI project's success is largely based on adoption.

Although BI has significant potential to improve the performance of an organisation, a review of the literature indicates that a large number of companies often fail to realise the expected benefits of BI and sometimes consider the BI project a failure in itself.

Within the UK National Health Service, data systems are very diverse and high in number. Historically this has made it difficult to provide quality information across multiple operational areas. The majority of healthcare trusts have relied upon reporting silos for each core system and manually reviewed this data to draw insight for operational improvement. In many cases, NHS Trusts employ a team of data analysts to collate the key performance information monthly and produce a board report for executive review. This process is time consuming, expensive and fails to deliver real time information which can support additional analysis. These combined challenges have driven the need for BI within Trusts, supporting the national targets to deliver higher quality, more consistent healthcare at a lower price.

Research Background

This whitepaper is based on research carried out by Navjot Kalra, an MBA graduate at the Henley Business School. More than 50 NHS Trusts took part in the study and provided open and honest feedback regarding the perceived success factors relating to the adoption of BI within their organisations.

Research Focus

The paper focused on three key areas:

- The relative importance of the Critical Success Factors to BI & Analytics adoption in the NHS.
- The view of the stakeholder in the NHS about change management and project management.
- If a correlation can be established between change management and successfully adopted BI & Analytics projects.

The findings from this study highlight the need to focus on user adoption to drive project success and minimise the impact of change at every level within the organisation.

Key Findings

Strong correlations were found between core aspects of change management and project management principles and the perception of project success. In addition, it was recommended that management actions during the project should clearly support the project to increase success and user adoption. Further key findings included:

- **Main stakeholders** referred to the project as a successful when they were identified and systematically managed.
- **Implementation and deployment** in small iterative steps showed a strong correlation to success.
- **Dashboards** which solved a specific data or business challenge showed a high correlation to project success.
- **User support and engagement** during and after implementation led to planned business benefits and the main stakeholders referred to the project as a successful project.

Research Format

A literature review was undertaken to look at previous research in this area and assess the recommendations for the critical success factors relating to BI in the industry. The conclusions from the literature review formed the basis for the quantitative survey that was sent out to participants. This survey enabled the researcher to gather a wide range of views from various departments and various roles relating to BI & Analytics projects across the NHS.

Section 1 Introduction of key concepts used in the research

1.1 The difference between traditional BI and data discovery

The promise of traditional business intelligence (BI) software is to enable decision makers at all levels in an organisation to leverage data for business advantage—to explore data, draw insights and meaningful conclusions, and make better decisions. Traditional BI solutions have delivered reliable, operational data tied to pre-defined, static reports, but haven't provided the self-service, on-the-fly, user-driven source of insight people crave for addressing daily business challenges. IT organisations tended to favour report-based BI solutions from stack vendors like IBM, Microsoft, Oracle, and SAP. But business users are becoming more vocal, demanding and influential than ever. They are going out and purchasing BI software on their own and they're not buying traditional BI solutions. Business users are choosing what Gartner calls data discovery platforms (Gartner, 2010) and they're buying in droves. According to market research firm IDC, end-user query, reporting, and analysis tools (which include Data Discovery platforms) comprised more than 80% of the BI tools market in 2010. In this research, IDC found that smaller vendors such as Qlik are outpacing the overall market growth. (IDC, 2010)

1.2 User adoption of software

User adoption deals with the transfer (conversion) between old systems to a target system in an organisation. So if a company works with an old software system, it may want to use a new system which is more efficient, has more work capacity etc. So then a new system needs to be adopted, where after it can be used and the old systems need to be discarded. Adoption is one of the most important factors for the success of any software implementation. It does not matter how useful or technically advanced the software is, unless the users are convinced of the benefits and start to use the software it will not have the planned business benefits.

1.3 Critical Success Factors

Rockart (1979) suggested that "Critical success factors" are, for any business, the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organisation. They are the few key areas where "things must go right" for the business to flourish. If results in these areas are not adequate, the organisation's efforts for the period will be less than desired. As a result, the critical success factors are areas of activity that should receive constant and careful attention from management". CSF's can also be applied to a sector or an industry.

1.4 Change management

Change management is related to the transition and emotional process that individuals undergo when a change in their environment requires them to change their normal behaviour.

1.5 Project Management

A project is an endeavour in which human, financial and material resources are organised in a novel way to undertake a unique scope of work, of given specification, within constraints of cost and time, so as to achieve beneficial change defined by quantitative and qualitative objectives. (Turner, 1999) .According to Turner, Project management is about managing people to deliver results and what needs to be managed in particular is "the scope of work" , the project organisation (the people who will do the work) and the quality, cost and duration.

Section 2 Theoretical Background

Over the past few years, there have been several empirical studies on CSFs in BI for example Yeoh et al. (2007); Wixom and Watson (2007); Hawking & Sellitto (2010); Yeoh & Koronios (2010); Olbrich et al. (2012); Presthus et al (2012). As a general consensus, committed top management support, source system data quality, user involvement and change management, merged consistently as the most important CSFs. Figure 1 depicts the relationship between the CSF's at various stages of BI implementation.

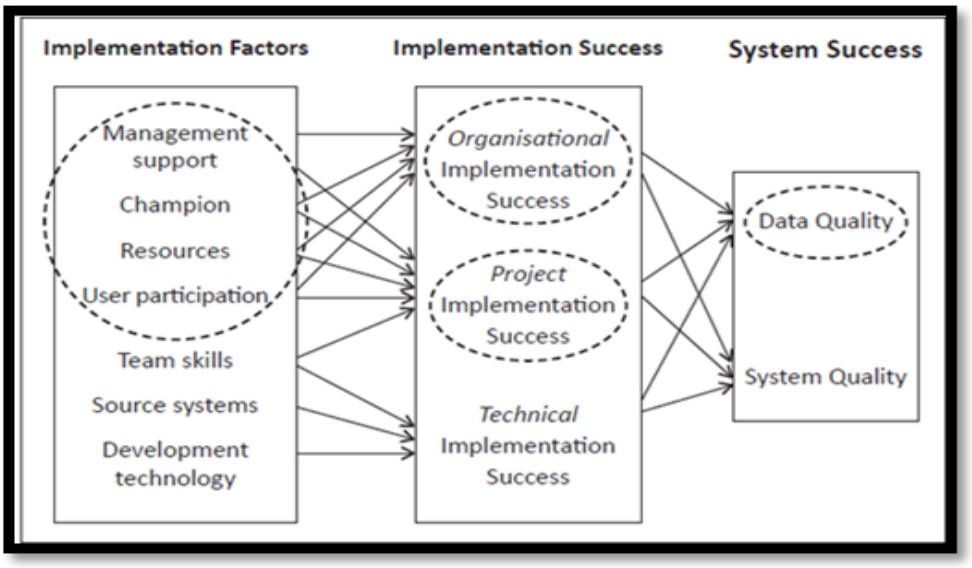


Figure 1 CSF's for BI success Wixom and Watson (2007)

Wieder (2012) suggests that considering that BI systems are discretionary 'informational' systems in a sense that they are not required for business process execution or other forms of transaction processing, the particular importance of addressing user satisfaction and (the relationship with) actual use of the system is obvious.

Further to the fact stated above, BI systems are often deployed as alternatives to 'islands of spreadsheets', with the latter often remaining in place as some form of shadow systems. It is therefore expected that there will be a large variation in BI system use across organisations, even if they deploy similar BI solutions, and it can be concurred with DeLone and McLean's (1992) assessment of the important role of IS use in terms of achieving benefits associated with the system. Finally, Cox's (2010) recent research confirms the positive association between frequent BI use and quality and speed of decisions.

The importance of proper project management was already emphasized in early studies on critical success factors of data warehouse projects (Wixom and Watson, 2001), and still remains a critical dimension of BI maturity (TDWI-Research, 2008). Wixom and Watson (2001) found that management support and resources help to address organisational issues that arise during warehouse implementations, and that adequate resources, user participation and highly-skilled project team member's increase the likelihood that warehousing projects finish on-time, on-budget and with the right functionality. Olbrich et al., (2012) write that depending on the industry and type of organisation, some

critical success factors will have a greater influence on the BI solution than others will. The challenge for organisations is to identify the factors that have the greatest influence on their BI system. An important criterion organisations should remember when they select the factors, is that they must have some effect on the factors for the duration of the project. The effect can be partial because they will set guidelines for how they expect to meet the target for a factor, whereas full control defines the expectations of what the target for the factor is precisely. By focusing on these critical success factors, organisations will be able to provide the platform for increasing the potential success of the IT solutions.

In all versions of DeLone and McLean's (1992; 2002; 2003) information systems success model, user satisfaction and system use are key links between information quality and individual impacts or net benefits respectively. DeLone and McLean Information success model focuses on the net benefits of implementing an IS system by the intention to use and the user satisfaction. The Figure 4 below shows an adaptation of DeLone and McLean IS model to a successful BI implementation.

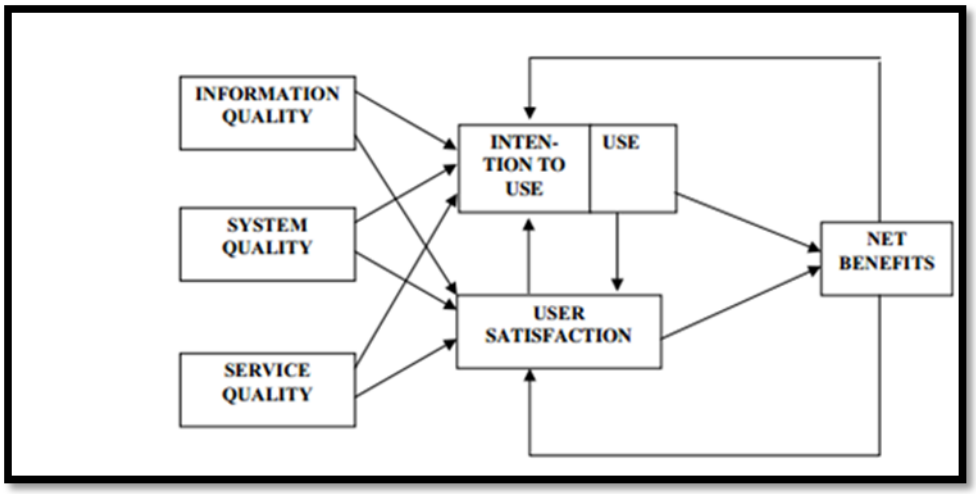


Figure 2 Updated DeLone and McLean IS success Model

Yeoh et al (2008) used the Delphi method to develop a critical success factor framework to understand the CSF's for BI implementation. Based on the ratings of the critical success factors by the Delphi participants, committed management support and sponsorship is the most important factor for the successful implementation and adoption. The implementation of BI is a financially large and complex undertaking Watson (2004) which is also reinforced by William Yeoh' s Delphi study Yeoh (2008). The CSF's from Yeoh's study mentioned have been summarized in Table 1 below:

Critical Success Factors	Mean	Std. Dev
• Committed management support and sponsorship	4.16	0.99
• Business user-oriented change management	4.10	1.00
• Clear business vision and well-established case	4.09	0.90
• Business-driven methodology and project management	4.08	0.88
• Business-centric championship and balanced project team composition	3.94	0.89
• Strategic and extensible technical framework	3.90	0.89
• Sustainable data quality and governance framework	3.82	0.91

Table 1 Summarised CSF's based on Delphi Study by Yeoh et al (2007)

Section 3 Summary and Definition of the CSF's

3.1 Top Management Support

Consistent support and sponsorship from business executives makes it easier to secure the necessary operating resources such as funding, human skills and other requirements throughout the implementation process. These organisational challenges arise during the course of the cross functional implementation as it is often uncovers many areas as business process, data ownership, data quality and stewardship and organisational structure. Many functional units tend to focus on tactical gains, ignoring the rippling effects imposed on the other business units.

(Olson and Zhao, (2007); Sammon and Finnegan,(2000) , Watson et al (2001), Lambert (1995))

3.2 Clear Goals and objectives/Clear Business Vision

As a BI initiative is driven by business a strategic business vision is needed to direct the implementation effort. Long term vision, primarily in strategic and organisational terms is needed to enable the established of BI business case. The business case must be aligned to the vision because it would eventually impact the adoption and outcome of the BI system. A solid business case would provide justifiable motivations for adopting a BI system to change the existing reporting and analytical practices.

(Yeoh W et al 2010, Wu J et al 2007, Olson and Zhao, 2007, Finney and Corbett, 2007)

3.3 Business user oriented/ Change Management

The industry/academia perceive that better user participation in the change effort can lead to better communication of their needs which in turn can help ensure the BI system's successful implementation and adoption. This is particularly important when requirements for a system are initially unclear, as is the case with many of the decision-support systems that a BI system is designed to sustain. No matter how good the system is, people must be motivated to use the system and have sufficient knowledge on how to use it effectively. Furthermore, when users are actively involved in effort, they have a better understanding of the potential benefits and this makes them more likely to accept the system on completion. Addressing this soft change aspect is rarely if ever given attention.

(Wixom and Watson, 2001, Seddon et al 2010, Collerette et al 2007, Olson and Zhao, 2007)

3.4 Effective project/stakeholder management

Organisations should use structured and formal approach for BI projects .Many projects fail to adequately account for organisational requirements, resources and funding necessary to support successfully adopted BI implementation. PM includes coordinating, scheduling, scope and monitoring activities and resources in line with the project objectives. The project has to start with a powerful steering group, establishing core project team, establishing sub team, defining roles and responsibilities clearly and building a good master project plan with time lines.

Yeoh et al 2007, Bhatti 2005, Wixom and Watson 2001, Ammot 2008)

3.5 Data and Information Accuracy and Integrity

The quality of data, particularly the source system is crucial if a BI system is to be implemented successfully. The primary purpose of the BI system is to integrate "silos" of data sources within the enterprise for a advance analysis so as to improve the decision making process. Often data related

issues within the backend systems are not discovered until that data is populated and queried against the BI system. The management should be involved in data governance and stewardship efforts to improve quality of data in the back-end systems because unreliable data sources will have a ripple effect on the BI applications and subsequent design/adoption outcomes.

(Sammon and Finnegan 2000, Rudra and Yeo, J Motwani et al 2002 Mukherjee and D'Souza)

3.6 System Perceived Usefulness and learnability/User oriented friendly technologies

The implemented system should be perceived to solve an existing pain in an easy manner and it should be easy manner and it should be easy to learn by the users. The perception of the implemented system should be a useful one in providing the benefits.

(Y, Yusuf et al 2004, Chenweth et al 2006 Mukherjee and D'Souza, 2003)

Section 4 Change Management and Transition Curve

Any BI project and the outcome will bring about a change in the work situation for the users as both people and the organisation will need to go through a transition where the organisational culture or structure will change. Therefore there is a need to manage this change to avoid structural as well as mental barriers.

Schein (2003) proposed a conceptual model for culture change focuses mostly on the fact that change creates a learning anxiety. The higher the learning anxiety, the stronger is the resistance and the defensiveness. Unfreeze Change, Freeze Lewin (1951) or Kotter's 8-Step Model, Kotter (2007) describe the urgency to change as an important factor in the process. These models have been developed following linear principles where change is assumed to be straightforward. As a consequence of reports of high failure in change projects this linear approach has been questioned by those who believe that change is more complex (Beer and Nohria ,2000; Stacy,1996).

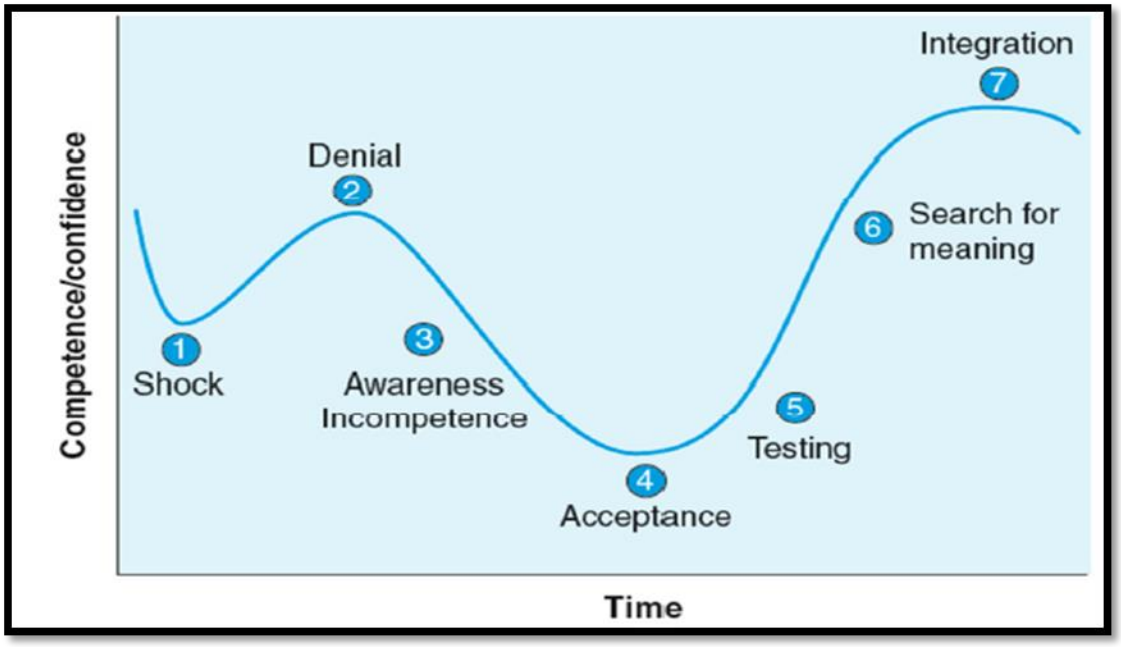


Figure 3 Transition curve–Adaptation of Adam et al (1976)

Figure 3 represents the transition curve which is based on Adams et al (1976) review of 15 models from different disciplines related to human response to change and transition. The majority of models describe a process that starts with some form of normality then goes through a disruption and finally ends up in a redefined normality similar to the transition curve shown below.

The mobilise , move, sustain model by Balogun and Hope Hailey (2004) is based on Lewin's model and aims to link organisational and individual change. The authors emphasize the fact that the levers used in each stage must be adapted to suit the context of change. They also stress the importance of motivating a sustain phase so as not to revert to old behaviour. The figure 4 summarises out some of the actions that can be taken to help the users with the change.

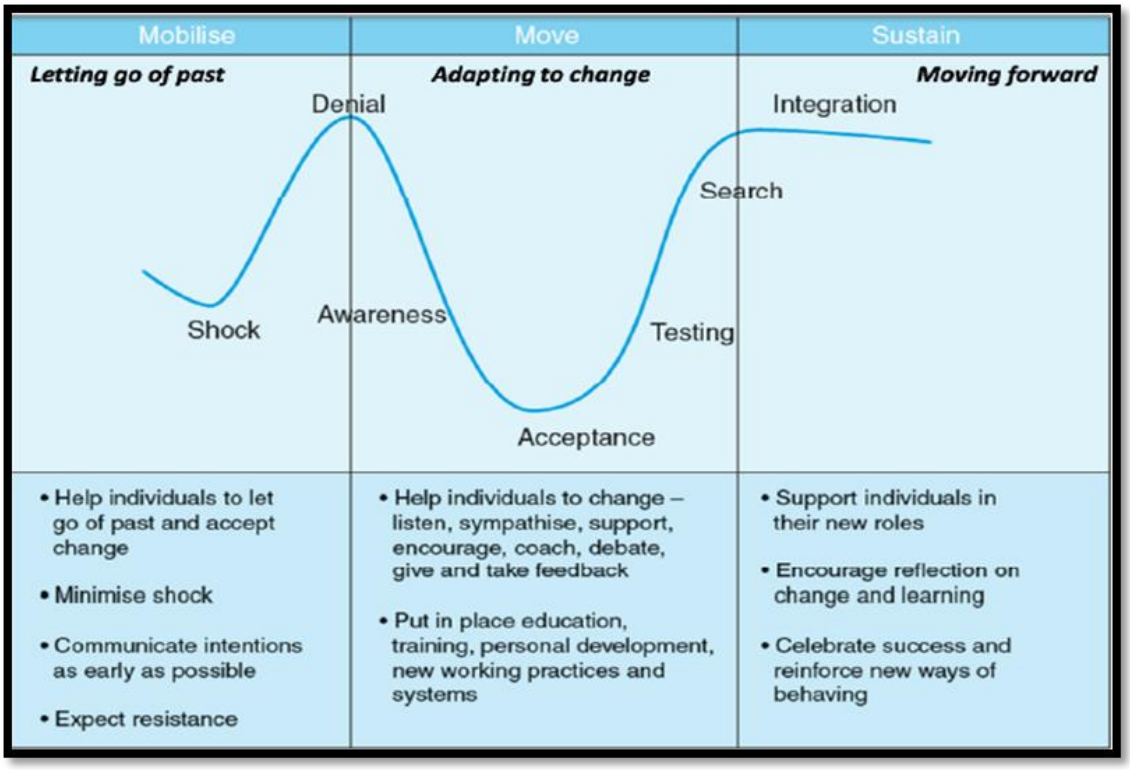


Figure 4 Transition Curve. Source Balogun and Hope Hailey (2004)

Section 5 Project Management/Stakeholder Management

According to Turner (1999)Project management is about managing people to deliver results and what needs to be managed in particular is “the scope of work” , the project organisation (the people who will do the work) and the quality, cost and duration .

The fact that projects are bound by time and aimed to deliver a pre-defined result and expected to follow a process imply a blue approach based on De Caluwe et al. (2003). In the blue design approach people are assumed to change if the end result is clear. The result is deemed independent of people and tools such as project management and quality management are used to achieve change. This approach however does not ignore the combination of a ‘hard’ structured approach with ingredients from other ‘soft’ people and organisational oriented approaches (Beer et al, 2000).

Basel (2009) describes project success as starting with a powerful steering group, establishing core project team, establishing sub team, defining roles and responsibilities clearly and building a good master project plan with a timeline.

The people management views represented by Gustavsson (2007), Turner (1999), and Project Management Institute (2008) indicate that IT projects run by traditional and also modern project management principles typically focus ‘people management’ efforts on individuals working within projects rather than those who will be affected by them.

Section 6 Research Structure

6.1 Research Assumptions

The following assumptions have been made for conducting this research:

- Assumption 1: The respondents to the survey are either the users of Qlik solutions or have been involved in the decision making to use the Qlik platform as a part of their BI roadmap.
- Assumption 2: These selected professionals have the knowledge, expertise and understanding of what BI/Analytics is and can at the same time identify the CSF's for adoption within the NHS.
- Assumption 3: Change Management is considered an important soft factor for the success of IT projects especially the one's which make people change their way of working.

The field research not only aims to find out the most relevant CSF's for adoption of BI, it also takes into consideration the opinion of the respondents.

6.2 Research Methodology

Based on Robson's (2002) work Henley Business School (2009:87) divides research designs into two categories, fixed and flexible designs. Fixed designs are concerned with aggregate properties; they have pre-specified data collection and analysis procedures. A deductive approach is most likely and the researcher is at a distance.

This research takes a deductive approach since it aims to test existing theory and variables from literature review against data. It aims to collect the data from about 50 different NHS trusts which have the BI software QlikView deployed which implies that the researcher can't be closely involved with the interviewees given the time constraints of this project. This motivates the selection of a fixed research design for this work.

6.3 Survey Methodology and Survey tools

Survey Monkey was used as the online survey tool. The survey was divided into four parts and the questions were based on a Likert scale. Each section was designed to address the research objectives as mentioned in Section 1.

6.4 Sample characteristics

The selected professionals for the survey have the following characteristics:

- They have experience of being involved with the implementation of Qlik and its usage.
- Senior or Medium ranked IT Managers and Project Managers with a good understanding of BI and project management
- Clinicians involved in using BI for best patient outcomes.
- Active involvement in making sure that projects are delivered in time and that BI is adopted.
- Active involvement with the strategy at NHS to reduce costs but deliver the best patient care.

6.5 Response rate and Reliability

The participation rate was 25% (N=62) of the sample of 250, which is in accordance with the academic guidelines.

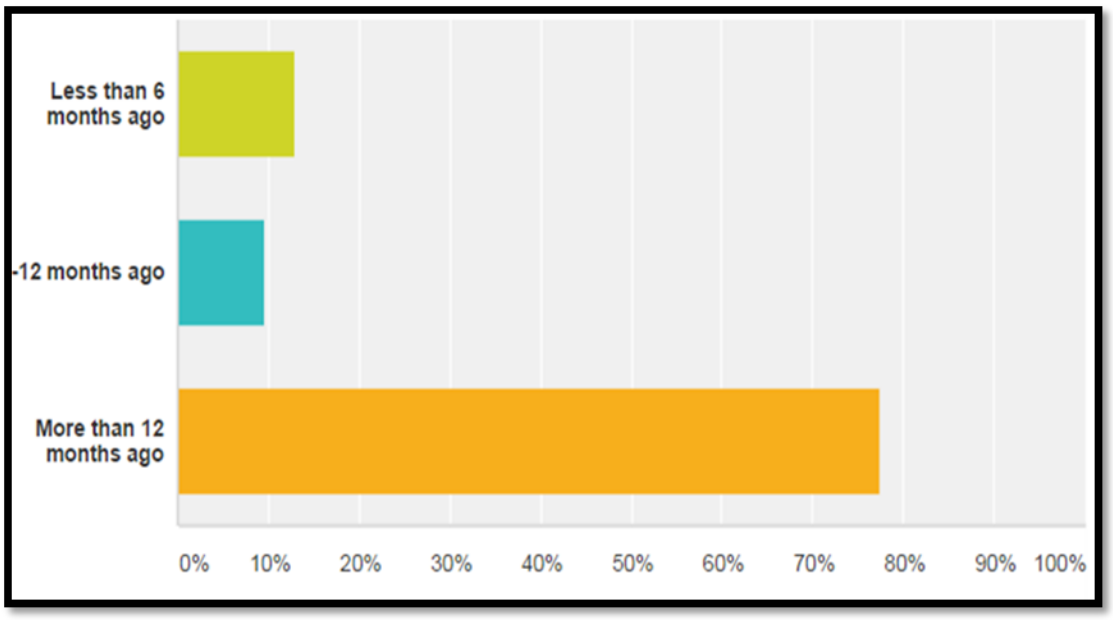
6.5.1 Cronbach's alpha

Commonly used as a method for reliability, the Cronbach Alpha for the response to the CSF questions is 0.83 which as a rule of thumb is considered to be good reliability and the sample and the sample responses can be used to draw professional conclusions

Section 7 Analysis from the survey results:

All data was analysed using the QlikView software and the results are presented below

7.1 When was the first Qlik BI application deployed?



The period for which the software has been in use gives the respondents the time to decide if they deem it as a successful project in terms of the outcomes.

7.2 The roles of the respondents in relation to the BI project

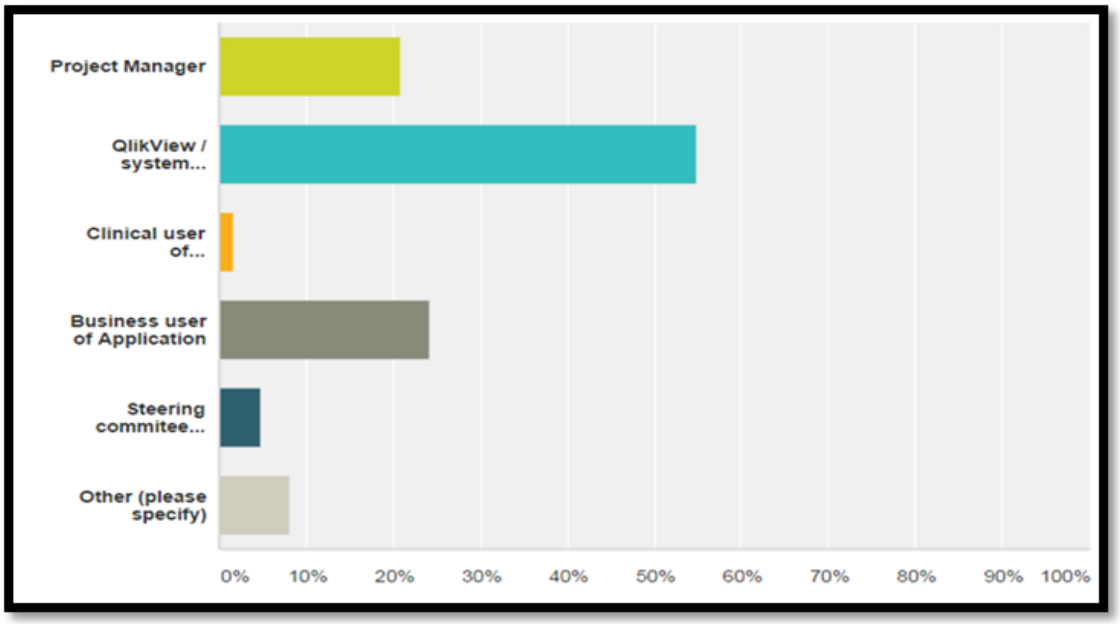


Figure 5The Roles of the respondents in relation to the Qlik project

It can be assumed that the sample distribution is representative of all the Qlik deployments in the NHS trusts. Qlik/System developers are the essential link between the user requirements and the

deployments. Their viewpoint has to be of extreme importance especially with relation to the adoption of the software by the end users. Conclusions and recommendations will impact the entirety of the scoped individuals.

7.3 Functional area in which Qlik applications were deployed

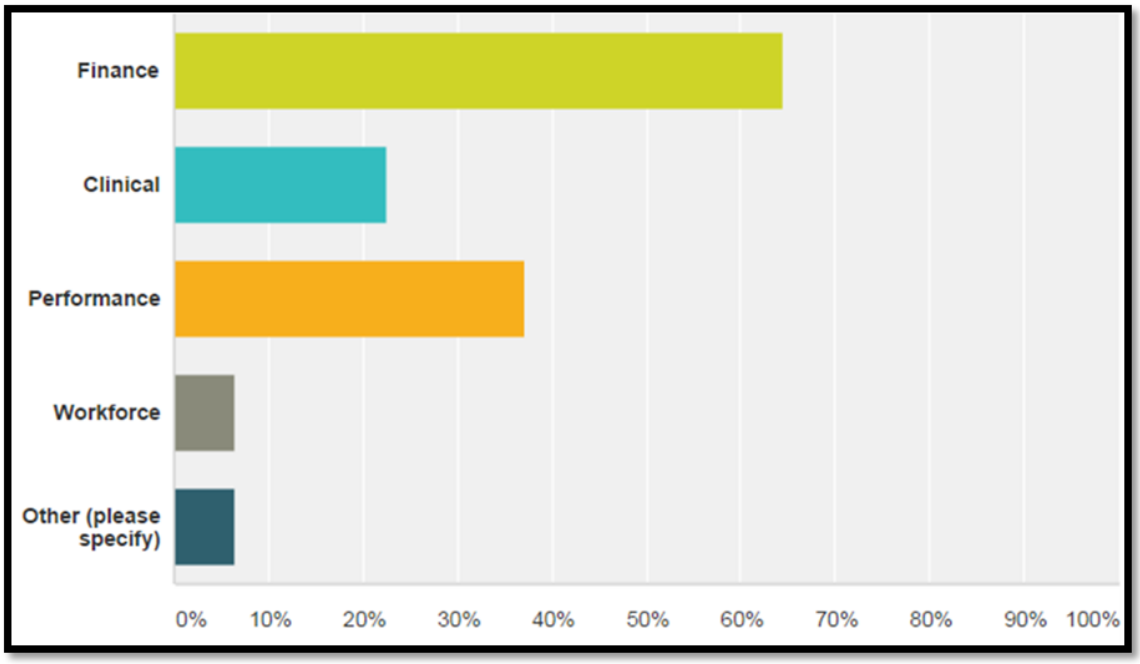


Figure 6 In which area of business was Qlik deployed first?

This shows that the finance function in the NHS are the largest user group. As explained in in the previous section which describes the context of this research cost savings is the driving factor for acquiring BI in the NHS. Hence looking at the results finance and performance are naturally the areas in which a majority of respondents come from.

7.4 Relative Importance of the Critical Success Factors of BI in NHS

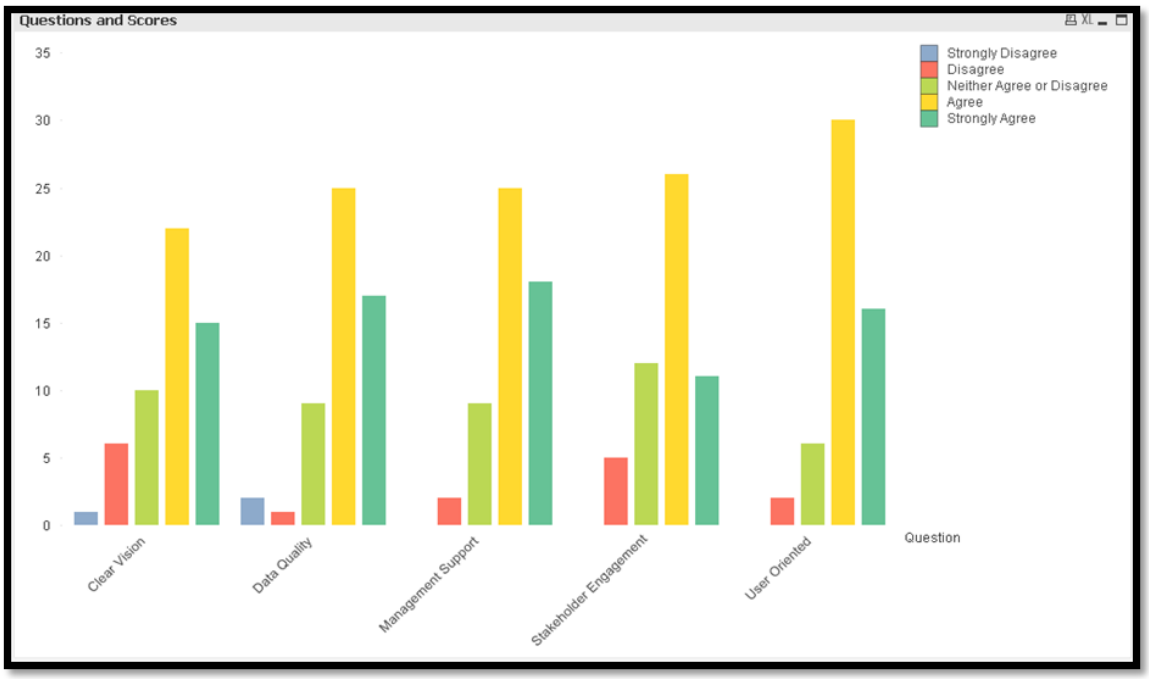


Figure 7 Percentage split for Qlik deployments in different business areas

The respondents were asked to indicate the extent to which they agree/disagree with the given CSF by selecting the appropriate option of using a 5-level Likert scale.
Change Management and Project Management are very broad topics in themselves. It was decided that change management and project management would be allocated separate sections in the survey.

- 85% agreed/strongly agreed with user friendly technologies.
- 80% of the respondents agreed/strongly agreed that committed management support and sponsorship for using Qlik in the NHS trust is a CSF.
- 78% agreed/strongly agreed with data quality.
- 70% agreed with stakeholder engagement.
- 69% agreed/strongly agreed that a clear vision and a well-established business case is a CSF.

The relative importance of the CSF's can be summarized as below

1. User Oriented
2. Management Support
3. Data Quality
4. Stakeholder Engagement
5. Clear Vision

7.5 Difference between CSF's for finance and clinical functions

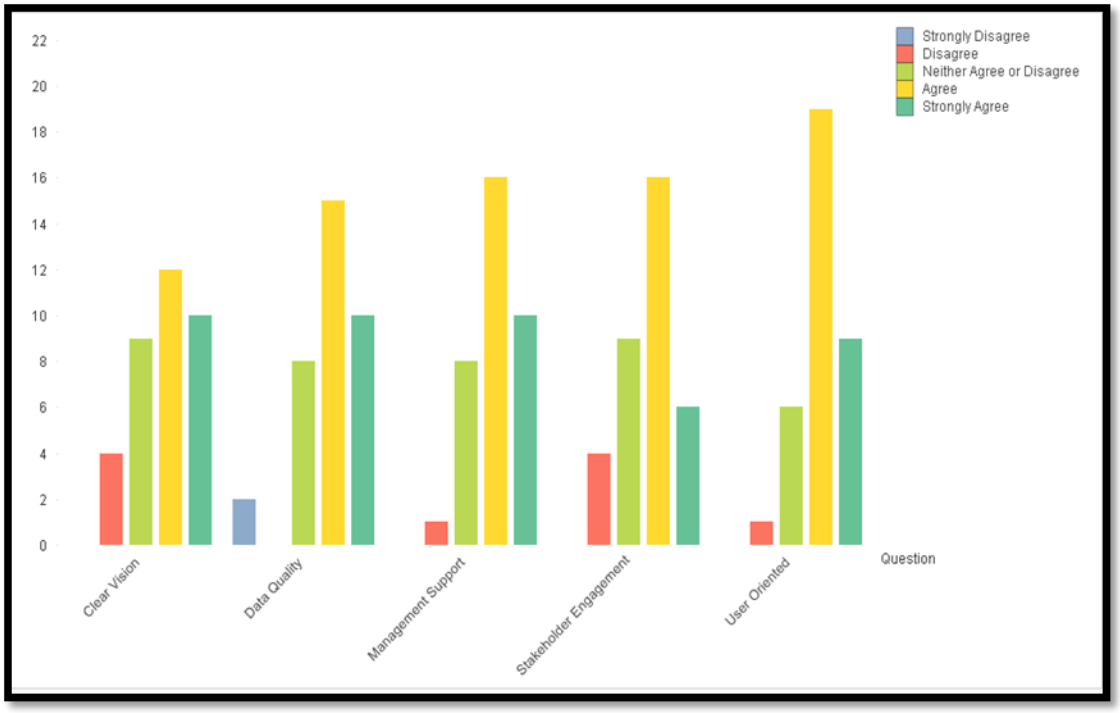


Figure 8 CSF's for finance function

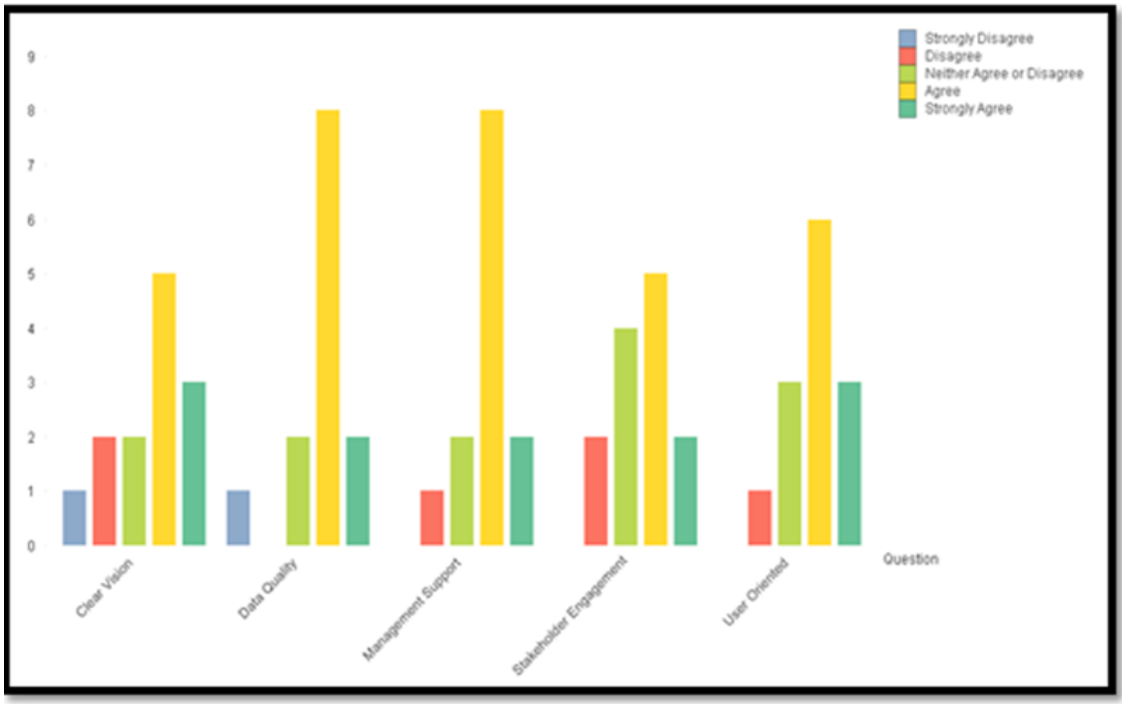


Figure 9 The relative importance of the CSF's for the clinical function.

To understand the requirements of the various functions in the NHS better it was decided to compare the differences between the CSF's for the finance department and the clinical departments. It is interesting to note that although similar results are seen, in the case of finance department the CSF user oriented is more important than CSF management support and data quality for the clinical side. Hence it can be

argued that BI is not static software compared to other software deployments and has to evolve and adapt to the need of the end users continually.

7.6 Is there any other CSF that has not been mentioned in the list that you consider important?

The open text question responses with the relative importance in descending order are stated below:

- Ease of use
- Stakeholder engagement
- Data quality.
- User training

The responses again confirmed three of the critical success factors as the most important and there were no surprises here. The CSF‘s that was not explicitly mentioned is user training. User training is about putting in place education training, personal development, new working practices and systems.

Section 8 Analysis of Responses related to Change Management

8.1 The comparison of the factors in the move/change phase

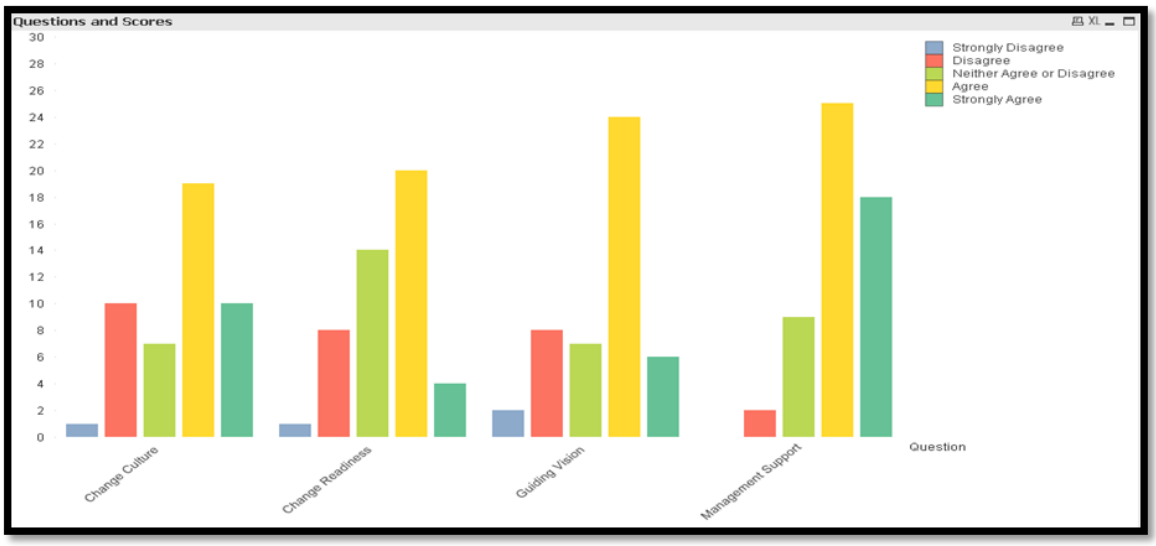


Figure 10 The comparison of all the questions related to the “Mobilise” phase

8.2 The comparison of the factors in the move/change phase

It is concluded that management support (64%) is the most important for mobilizing the change required to bring in a new BI system. This is closely followed by change culture, guiding vision and change readiness. It can be argued that some of the departments were not ready for the change as only 49% respondents agreed that the department including the affected users, clearly understood and bought into the challenges or the problems which were the reason for implementing the Qlik platform. The results of responses emphasise that although the department had a positive attitude and history of introducing or changing IT systems to improve operations it did not imply the department was ready for a new change and this should be paid attention to in future projects.

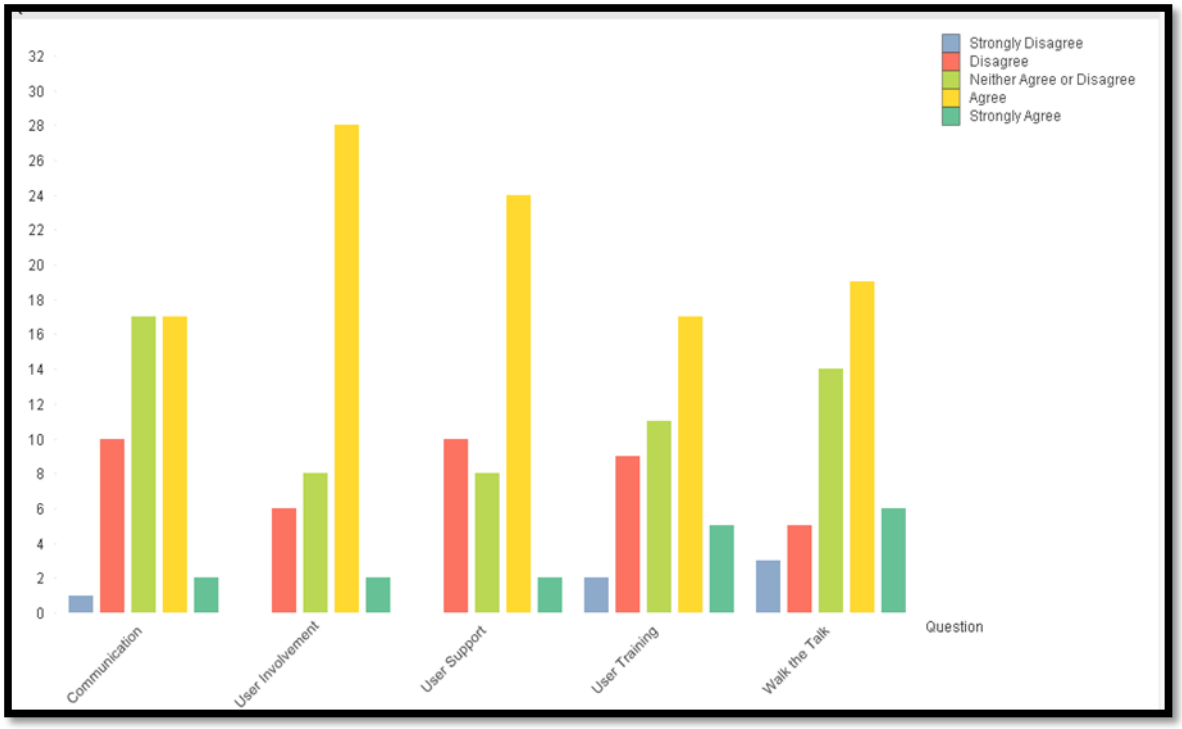


Figure 11 The comparison of the factors in the move/change phase

- 66% agreed with user involvement
- 54% agreed with Walk the talk
- 51% agreed with user support
- 50% agreed with user training
- 41% agreed with communication

With regards to communication only 41% agreed that effective communication channels were continually used during the BI project to keep the organisation informed about the project status and progress. It is therefore concluded that although the users were involved many aspects of the move process could have been paid better attention in order to manage this phase better. This is a crucial part in adoption of the software as shown in the figure 5 (transition curve). There is a need to pay enough attention to these factors or else the users will not accept the change.

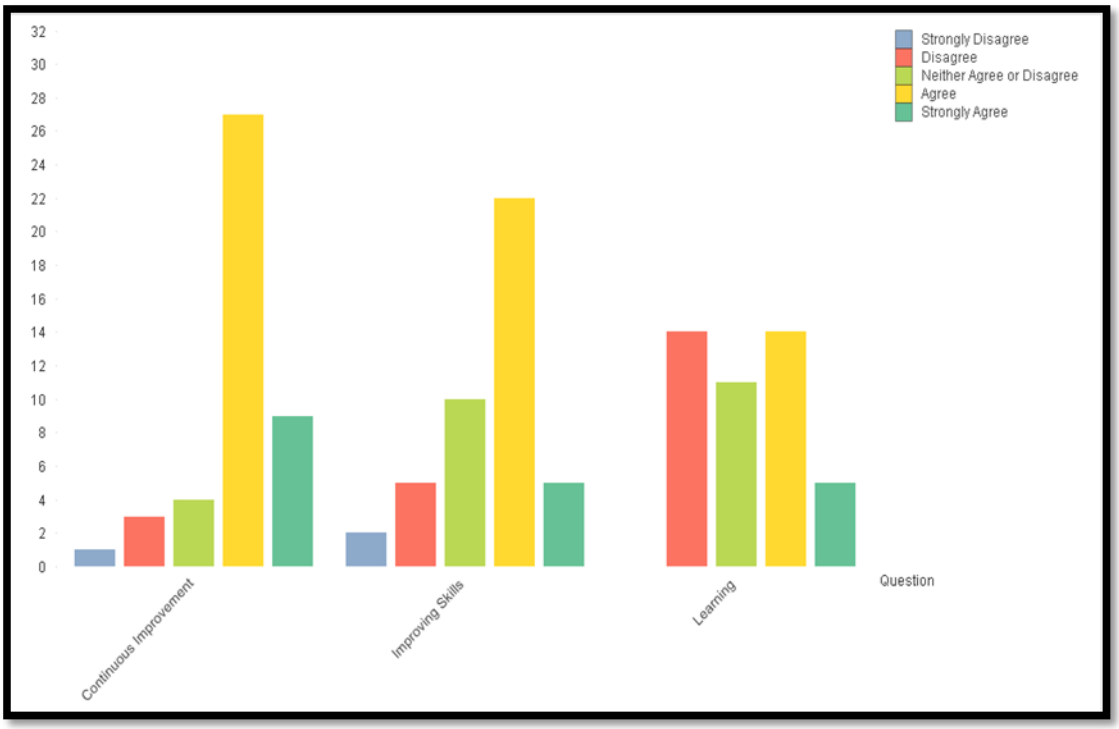


Figure 12 Comparison of the factors in the sustain/refreeze phase

- 72% agreed with continuous improvement
- 62% agreed with improving skills
- 42% agreed with organisational learning

Only 42% agreed that after implementation, the implementation process and outcome were evaluated and results were communicated to the organisation. NHS trusts should focus on the outcome of the projects and the results should be communicated to the stakeholders in the NHS.

Section 9 Analysis of Responses related to Project Management

9.1 Comparisons of the project management factors

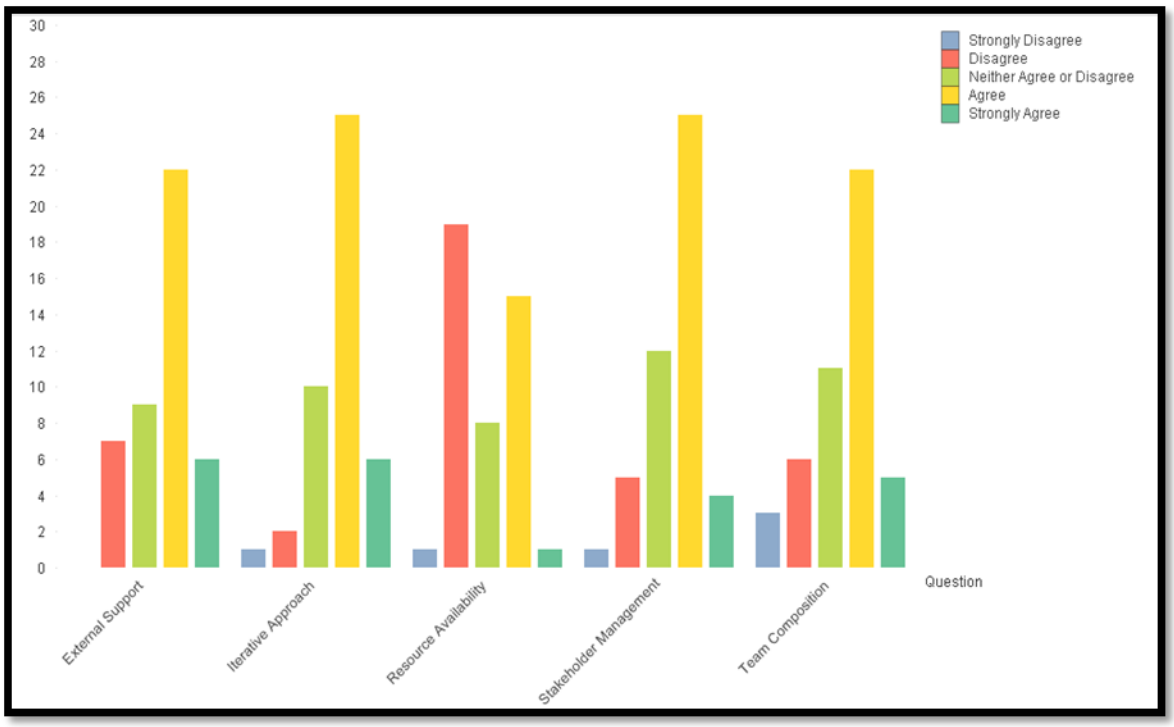


Figure 13 Comparison of the project management factors

Responses

Question	Mean	Standard Deviation	Median	Mean Score - Standard Dev
	3.45	**0.97516859**	**4**	**2.476**
External Support	3.61	0.9204627	4	2.693
Iterative Approach	3.75	0.83874214	4	2.911
Resource Availability	2.91	0.98401602	3	1.925
Stakeholder Management	3.55	0.87993356	4	2.673
Team Composition	3.43	1.0579858	4	2.368

Figure 14 Statistical Analysis of the project management factors

9.2 Results of the analysis of the project management factors

- 71% agreed with iterative approach
- 65% agreed with external support
- 63% agreed with stakeholder management
- 58% agreed with team composition

Iterative approach implies Qlik was implemented and put into operation in small iterative steps. External support means that external consultants or Qlik partners were used in the project as expertise to complement internal resources. Stakeholder Management means the main project holders for Qlik were identified and systematically managed. Team composition means that the project management team

included or had all the competencies needed. Resource availability means that the Qlik project had sufficient human, financial and material resources during the project. This is the most notable outcome from this question was that only 38% of the respondents agreed with this aspect.

Iterative approach is chosen as the most significant factor for project management. It can be argued that it is easier to demonstrate the usefulness of the BI software if the return on investment can be documented in smaller projects first and then more departments can follow. This is especially significant for the NHS as there have been projects in the past that have failed in the past leading to financial and resource losses.

It is also noted that the respondents felt that resource availability was not optimum and that could be made better in the future. With reference to Wixom and Watson (2001) both management support and resources help to address organisational issues that arise during warehouse implementations. Hence enough resources dedicated to the project is crucial.