Information Systems Frontiers (2023) 25:917–927
https://doi.org/10.1007/s10796-022-10253-w

# An Empirical Investigation on Business Analytics in Software and Systems Development Projects

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Accepted: 24 January 2022 / Published online: 20 April 2022


**Abstract**
To create competitive advantages, companies are leaning towards business analytics (BA) to make data-driven decisions. Nevertheless, users acceptance and effective usage of BA is a key element for its success. Around the globe, organizations are increasingly adopting BA, however, a paucity of research on examining the drivers of BA adoption and its continuance is noticeable in the literature. This is evident in developing countries where a higher number of systems and software development projects are outsourced. This is the first study to examine BA continuance in the context of software and systems development projects from the perspective of Pakistani software professionals. The data was collected from 186 Pakistani software professionals working in software and systems development projects. The data were analyzed using partial least squares - structural equation modelling techniques. Our structural model explains 45% variance on BA continuance intention, 69% variance on technological compatibility, and 59% variance on perceived usefulness. Our results show that confirmation has a direct impact on BA continuance intention in software and systems projects. The study has both theoretical and practical implications for professionals in the field of business analytics.

**Keywords** Business Analytics · Data-Driven Decision · Information Systems · Technological Compatibility · Continuance Intention

## 1 Introduction

Businesses are collecting a range of data to achieve greater competitiveness across the globe. Business Analytics (BA) provides insight into data with the help of business knowledge to support decision-making processes. Recently, BA has received considerable attention in various industries to gain a competitive advantage (Nam et al., 2019; Wang et al., 2019). BA can be defined as "the techniques, technologies, systems, practices, methodologies, and applications that analyze critical business data to help an enterprise better understand it's business and market and make timely business decisions" (Chen et al., 2012, p. 1166). BA is about leveraging value from data - deemed 'the new oil' (Acito & Khatri, 2014). All types of analytics (e.g. BA, data analytics, mobile analytics, text analytics, web analytics, and network analytics) rely on data mining, statistics and artificial intelligence techniques and natural language processing (Chen et al., 2012). According to the IDC 2017 report (Dan et al., 2021), the BA software market was $54.1 billion and it will increase by 11.2% in 2022. BA helps to improve the firm's agility and performance as well as generate greater competitiveness for an organization (Ashraf et al., 2019; Chiang et al., 2018). In software development, analytics guides practitioners in decision making throughout the software and systems development process. According to Ashraf et al. (2019), BA enhances information quality and innovative capabilities. Quality information contributes to timely

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decisions and better adaptability to the environment. Aydiner et al. (2019) highlighted that BA helps in improving business process performance.

BA use and adoption is a multidimensional and multi-factor phenomenon. These factors could be connected to technology (data infrastructure, data quality management), organization (managerial obstacles, analytic centralization) or environment (competition intensity). According to Gartner Research (Howson & Sallam, 2017), only 30% of businesses are using BA in their decision-making process. The absence of well-defined strategic goals is a dominating factor for organizations failing to integrate BA into their system. The majority of analytic projects fail for two main reasons: employees or users are lacking data skills and management lacking big data leadership and capabilities (Persaud, 2020). Recent studies have focused on BA tools rather than paying attention to users and the context in which they are used (Bawack & Ahmad, 2021; Conboy et al., 2020; Mikalef et al., 2019). Other studies focused on defining the concepts of BA, the effects of BA on the future of the businesses, and analysis of firms' performance and business values with the use of BA; however, there is a general lack of guidelines for companies to successfully adopt BA in their business environment (Abbasi et al., 2016; Acito & Khatri, 2014). However, only a few empirical studies have been conducted to investigate the drivers and barriers of BA-related technology adoption in an organization (Chen et al., 2012; Chiang et al., 2018), which makes it difficult to generalize the results; confirming the fact that guidelines for BA adoption are still in the early stages (Abbasi et al., 2016; Bawack & Ahmad, 2021).

For many years, BA has been viewed from three perspectives, i.e., descriptive, predictive, and prescriptive (Cao, 2017). Recently, BA is extended to the fourth perspective “adaptive analytics" which not only analyzes the past but is also able to respond in real-time to the actions of a user (Biesialska et al., 2020). Maximizing the value of BA investments requires pervasive use by the users which meets their expectations such as insights, visualization, mobility, and user engagement (Wixom et al., 2013). By keeping humans in the loop BA analytics is the embodiment of actual decision making. Individuals perceived these factors and influence BA adoption differently (Nam et al., 2019). Their needs and expectations in the use of BA is a challenge (Bawack & Ahmad, 2021). Such expectations affect individuals’ perceptions of how to fit BA in their jobs. This sheds light on the importance to understand what software and system development team members expect from BA and the effect this has on their desire to continue using BA. Analytics technologies reshaping the work environment and pushing individuals to learn a new set of skills to progress in their profession (Persaud, 2020). Further, understanding user expectations is an effective means of assessing and predicting information systems success or failure and the continuance of its use (Bhattacherjee, 2001; Szajna & Scamell, 1993). The latest literature on analytics calls for studies to explore how BA better fits with user expectations; whereas others suggest studies to understand the behavioural decisions of BA users regarding the (continuous) use of BA in organizational contexts (Bawack & Ahmad, 2021; Dennehy et al., 2020; Elhoseny et al., 2020; Jaklic et al., 2018).

This paper aims to examine how software and systems development professionals’ expectations from BA affect their perceptions and continuous use of BA? We are seeking to answer the research question: *What are the factors that affect BA continuance in software and systems development projects?* We used the expectation-confirmation model (ECM) (Bhattacherjee, 2001) as our theoretical framework to hypothesize on the behaviours of software and systems development professionals vis-a-vis their expectations from BA investments made by their organizations. The adopted model provides a basis to identify the interrelationships between the investigated factors. To this end, we collected data from software and systems development professionals in Pakistan and received a total of 186 responses. The model is empirically tested using the partial least squares approach - structural equation modelling technique.

The remainder of this paper is organized as follows: Section 2 presents the research model and formulate hypotheses. Section 3 discusses the research methodology. Section 4 provides the results and Section 5 discusses the key findings, theoretical and practical implications as well as limitations of the current study and future research directions. Finally, Section 6 concludes the paper.

## 2 Theoretical Development, Proposed Research Model and Hypotheses Formulation

The objective of this study is to examine BA continuance in the context of software and systems development projects from the perspective of Pakistani software professionals. The expectation-confirmation model (ECM) (Bhattacherjee, 2001) is used as a basis for designing empirical research. ECM is based on Expectation Confirmation Theory (ECT) that is extensively used to gauge consumer satisfaction and post-purchase behaviour. ECT elaborated the consumer process to have a repurchase intention; before purchase where he/she forms an initial expectation; after purchase where the consumer forms a perception about the performance of the purchase and make comparison with original expectation (Halilovic & Cicic, 2013). This highlights that customer satisfaction forms a repurchase intention whereas dissatisfaction results in discontinuation. The same logic of users’

satisfaction applies to the information systems continuance intention to use. Bhattacherjee (2001) presents ECM in the information systems field and elaborated the cognitive beliefs that influence users' intentions to continue using information systems. Intention to continue to use of any information systems can be determined by its users' satisfaction as well as perceived usefulness for its continuous usage.

ECM posits that continuance intention to use is linked with post-perceived usefulness and users satisfaction. Perceived usefulness, as well as confirmation expectations from the initial use, contribute to user satisfaction. Additionally, perceived usefulness is also influenced by confirmation. The existing studies show that ECM is extended and validated in various contexts such as online shopping, healthcare and understanding BA continuance in agile information system development projects (Bawack & Ahmad, 2021; Brown et al., 2014; Gupta et al., 2020; Wang et al., 2020; Wu et al., 2020). Intention to continue the use of any information systems can be determined by users' perceived usefulness for its continuous usage. We use ECM as the theoretical foundation to investigate continuance intention to use BA in software and systems projects. Similar to Bawack and Ahmad (2021), we added the technological compatibility construct to the ECM model. Various studies reported that technological compatibility affects users' intention to continue using new technologies (Bawack & Ahmad, 2021; Ahmad et al., 2021; Cheng, 2020; Gupta et al., 2020). Similarly, we expect that perceived usefulness, technological compatibility and confirmation contribute towards BA continuance intention. Figure 1 summarizes our conceptual model for this research.

### 2.1 Confirmation → Perceived Usefulness

Confirmation is the degree to which the actual use experience confirms their initial expectation (Bhattacherjee, 2001).

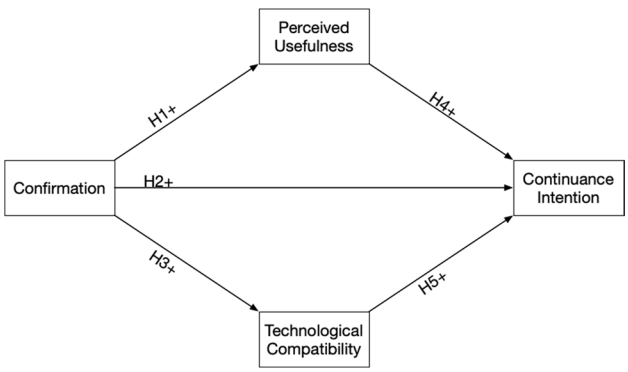


**Fig. 1** Proposed research model (Adapted from Bhattacherjee, 2001)

It means that users' actual use experience meets initial anticipation or expectation; which leads to their satisfaction. On the other hand, when actual use experience does not correspond or fall below the initial expectation, dissatisfaction occurs because of failing to achieve expectations. Bhattacherjee (2001) elaborated confirmation as the understanding of the anticipated benefits of IS use and dis-confirmation as performance lagging expectancy failure to achieve expectation. Therefore, we hypothesize:

H1: Confirmation has a positive effect on the perceived usefulness of BA use.

### 2.2 Confirmation → BA Continuous Intention

Ratification of fulfilment comes after a meaningful experience, which is a sign of alignment between expectation and confirmation (Bhattacherjee, 2001; Gupta et al., 2020). A range of studies reported a relationship of among confirmation with, perceived usefulness and satisfaction (Bhattacherjee, 2001; Gupta et al., 2020; Huang, 2019; Shang & Wu, 2017; Susanto et al., 2016; Tam et al., 2020; Venkatesh et al., 2011). The same logic applies to BA use. BA users compare the experience of their BA use with prior expectations. If the users expectation is confirmed, then he/she will have a positive continuous intention use with the BA. We hypothesize that confirmation might have a direct connection with continuance intention. Therefore, we hypothesize the following:

H2: Confirmation has a positive effect on BA continuance intention.

### 2.3 Confirmation → Technological Compatibility

Several studies suggested that satisfaction with technology influences users' intention towards the use of technologies (Bawack & Ahmad, 2021; Cheng, 2020; Gupta et al., 2020). According to Bawack and Ahmad (2021), confirmation has a significant effect on technological compatibility that influence BA continuance. Similarly, we expect that if software and systems professionals find BA tools compatible with their work, they will intend to continue its use in their projects. Therefore, we hypothesize:

H3: Confirmation has a positive effect on technological compatibility.

### 2.4 Perceived Usefulness → Continuance Intention

Perceived Usefulness has an influence on user intention across temporal stages of information systems use and continuance use intention (Bhattacherjee, 2001). Perceived

usefulness has a direct impact on technology continuance intention (Bhattacherjee, 2001; Gupta et al., 2020). The BA users are more likely to perceive usefulness if prescriptive and predictive expectations are met. Therefore, we hypothesize:

H4: Perceived usefulness has a positive effect on BA continuance intention.

### 2.5 Technological Compatibility → Continuance Intention

Users are using the information systems when it matches their needs, values and expectations (Awa et al., 2017; Bawack & Ahmad, 2021). This is true in the case of analytics as well. According to Chen et al. (2015), organizations are more likely to use big data analytics when their existing values and work practices are compatible. Compatibility is an important driver in analytics acceptance and continuance (Grubljesic & Jaklic, 2015; Gupta et al., 2020). Building on the above reasoning, we hypothesize that:

H5: Technological compatibility has a positive effect on BA continuance intention.

## 3 Methodology

To reach the goal of our research, a survey instrument was developed based on a well-established model - ECM. The adopted model is also empirically investigated by Bawack and Ahmad (2021) in the BA context. Figure 1 illustrates the proposed research model and associated hypotheses of our research. The survey was pre-tested with two software industry experts and four researchers. Based on the feedback, we revised the statements to have clearer wordings. Survey questions are provided in Appendix 1 Table 5. The target respondents for this study were BA practitioners in Pakistani software and systems development companies. We contacted respondents directly through phone calls and emails. The study participating companies were using Agile software development techniques (Ahmad et al., 2018) in their projects.

The questionnaire was divided into three parts. In the first part, participants were provided information about the purpose of the research, its benefits as well as information about the researchers. The second part included demographic questions about the participants. The third part questions measured constructs in the research model. All of the variables related to the ECM model were measured using a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree).

The inherent nature of quantitative study can result in the introduction of measurement errors. To ensure that measurement errors originated due to common method bias (Podsakoff et al., 2003) are properly handled, we employed several steps. Firstly, and most importantly, all the respondents were informed that the survey is anonymous and that we will not store any personally identifiable information such as name, and/or IP address etc. The respondents were also encouraged to answer as honestly as possible by stating that there are no right and wrong answers. Some of the questions were rephrased to improve understandability for the target respondents. Second, to create psychological separations of measurement, the survey questions were juxtaposed. Third, pre-testing and pilot-testing of the questionnaire help to reduce the ambiguity of items and bring more clarity to each question. Fourth, Harman's single factor test was carried out to determine if the variance can be explained by a single factor. We achieved a score of 47%, which is less than the threshold value of 50% indicating that there is no threat of common method bias (CMB).

To evaluate our proposed model, we used Partial Least Squares Structural Equation Modeling (PLS-SEM). It is important to note that PLS-SEM is the standard and well-established approach used in quantitative research to study the relationship between variability and predictive models (Hair Jr et al., 2016). PLS-SEM is a variance-based SEM technique and is, therefore, the preferred technique for exploratory studies involving an investigation of relationships based on theory (Hair Jr et al., 2016). The PLS-SEM approach involves two steps; in the first step, evaluation of the measurement model occurs, whereas, in the second step, the structural model is evaluated (Hair Jr et al., 2017).

## 4 Results

In this section, we present and discuss the results of our study including demographics of respondents, measurement model, structural model and hypothesis testing.

### 4.1 Respondents' Demographic

We collected data from 186 respondents belonging to diverse domains. 41% of the respondents identified themselves as software developer. 27% of the respondents selected telecommunication as their job, whereas 15% belonged to the e-commerce industry. 6% of the respondents are working as IT-Consultants, and 4% are working in a government organization. The remaining 7% worked in various other sectors. 61% of the respondents have a minimum of three years of experience using BA in their work, and the remaining respondents have one to two years of BA experience. The

**Table 1** Demographic features of the respondents (N=186)

| | Characteristic | Frequency | Percent (%) |
|---|---|---|---|
| Gender | Male | 159 | 85.48 |
| | Female | 27 | 14.52 |
| Age (Years) | 22-25 | 52 | 27.96 |
| | 26-30 | 71 | 38.17 |
| | 31-40 | 54 | 29.03 |
| | 40+ | 9 | 4.84 |
| Education | Bachelors | 127 | 68.28 |
| | Masters | 53 | 28.49 |
| | PhD | 6 | 3.23 |
| Experience (Years) | <1 | 7 | 3.76 |
| | 1-2 | 65 | 34.95 |
| | 3-5 | 76 | 40.86 |
| | 6-7 | 26 | 13.98 |
| | 7+ | 12 | 6.45 |

majority of respondents are male (85%). Further demographics of the respondents are provided in Table 1.

## 4.2 Measurement Model

To evaluate the measurement model, we focus on assessing the reliability and validity of the constructs and their corresponding items. We consider factor loadings of the items, composite reliability and Cronbach Alpha (α) scores of the constructs. For individual items to be reliable, the factor loading should be at least 0.50. Table 2 presents the summary of the reliability and validity score of the measurement model constructs and items. It is evident from Table 2 that the factor loading for each item is well above the threshold of 0.50. Likewise, for construct reliability, the composite reliability and Cronbach's alpha scores should be greater than 0.70 (Hair Jr et al., 2016).

We used Average Variance Extracted (AVE) to validate if a construct sufficiently explains the variance of its items. The AVE score should be greater than 0.60 (Fornell & Larcker, 1981). A discriminant validity test is employed to ensure that unrelated constructs are not observed to be related to one another. For this purpose, we used the discriminant validity test of Fornell and Larcker (1981). The Cronbach's alpha (α), composite reliability and AVE scores are meeting the minimum threshold criterion.

Table 3 presents the discriminant validity score based on Fornell & Larcker method (Fornell & Larcker, 1981). The method compares the square root of each Average Variance Extracted (AVE) in the diagonal with the correlation coefficients of the other constructs. The square root of AVE should be greater than the corresponding correlation coefficients. As in each column (see Table 3), the top value (diagonal value) is the highest among all other values signifying that these constructs are not related.

**Table 3** Discriminant validity

| | BA-C | BA-CI | BA-PU | BA-TC |
|---|---|---|---|---|
| BA-C | **0.846** | | | |
| BA-CI | 0.658 | **0.795** | | |
| BA-PU | 0.770 | 0.588 | **0.785** | |
| BA-TC | 0.633 | 0.600 | 0.755 | **0.799** |

Note: The diagonal values in bold are the square root of AVE, whereas the non-diagonal values represent the correlation between constructs

**Table 2** Mean, standard deviation, reliability and validity score of the measurement model

| Construct | Indicator | Mean | Standard Deviation | Factor Loading | Cronbach's Alpha | Composite Reliability | Average Variance Extracted |
|---|---|---|---|---|---|---|---|
| Continuance Intention (CI) | CI-1 | 4.13 | 1.30 | 0.781 | 0.708 | 0.837 | 0.632 |
| | CI-2 | 4.22 | 1.31 | 0.773 | | | |
| | CI-3 | 4.18 | 1.32 | 0.829 | | | |
| Confirmation (C) | C-1 | 4.56 | 1.22 | 0.824 | 0.801 | 0.883 | 0.716 |
| | C-2 | 4.61 | 1.18 | 0.837 | | | |
| | C-3 | 4.58 | 1.3 | 0.876 | | | |
| Perceived Usefulness (PU) | PU-1 | 4.71 | 1.35 | 0.785 | 0.793 | 0.865 | 0.616 |
| | PU-2 | 4.56 | 1.31 | 0.755 | | | |
| | PU-3 | 4.8 | 1.43 | 0.838 | | | |
| | PU-4 | 4.59 | 1.27 | 0.761 | | | |
| Technological Compatibility (TC) | TC-1 | 4.57 | 1.33 | 0.801 | 0.716 | 0.841 | 0.638 |
| | TC-2 | 4.78 | 1.36 | 0.760 | | | |
| | TC-3 | 4.57 | 1.29 | 0.835 | | | |

### 4.3 Structural Model

In the evaluation of the structural model, we perform statistical assessments regarding the predictability of the underlying model as well as the significance of the relationships between various variables of the model. The underlying model should exhibit no collinearity among the constructs to reflect the absence of bias (Fornell & Larcker, 1981; Hair Jr et al., 2016), i.e., the p-value of the predicates should be less than 5%. To gauge the predictive accuracy of the model, we consider the $R^2$ score. Threshold scores of 0.25, 0.50 and 0.75 are used to indicate weak, moderate and substantial predictive accuracy of the model. The resultant structural model is illustrated in Figure 2.

For ensuring that the significance of the results is not by chance, we run a bootstrap of our model by considering 5,000 sub-samples. The analysis of the $R^2$ values shows that our structural model can explain 45% variance on BA continuance intention, 69% variance on technological compatibility, and 59% variance on perceived usefulness. Analysis of the path coefficients (β) of our structural model reveals that confirmation (β=0.441, p=0.000) significantly affects BA continuance intention. Whereas perceived usefulness (β=0.169, p=0.062) and technological compatibility (β=0.105, p=0.327) do not affect BA continuance intention. We also identified that confirmation affects perceived usefulness (β=0.770, p=0.000) and technological compatibility (β=0.833, p=0.000). The findings of the structural model evaluation are summarized in Table 4.

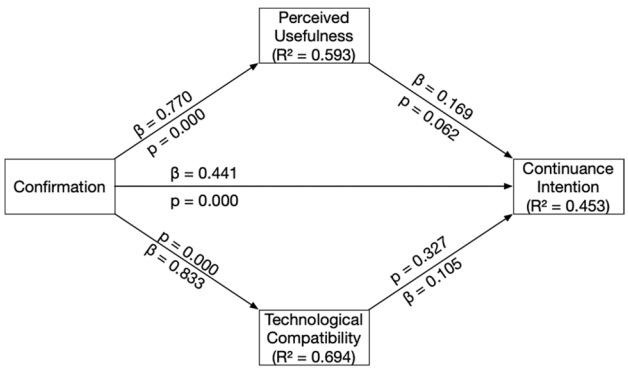


**Fig. 2** Validated Research Model

## 5 Discussion

We employed the ECM to explore what software practitioners in software and systems development projects expect from BA as well as how this affects their intentions to continue using the BA technologies adopted by their organization. A few existing studies focused on the implementation of BA technologies, but limited attention is given to its users or context of use (Conboy et al., 2020; Dennehy et al., 2020; Mikalef et al., 2019). Studies reported many factors influencing the successful implementation of BA, such as identifying skills, talents and building BA teams, obtaining the required certifications, involving stakeholders and creating a BA culture (Larson & Chang, 2016; Liu et al., 2018). However, none have investigated the factors influencing BA continuation intention after BA implementation. In this study, we used ECM as a theoretical foundation to understand the mentioned phenomenon from the perspective of Pakistani software professionals. The results of this study are consistent with existing literature that confirmation influence perceived usefulness and technological compatibility. Our study also shows that confirmation directly influences BA continuous intention. Festinger (1957) suggests that users experience psychological tension when their experience is disconfirmed during actual use. In the context of BA, confirmation tends to elevate users' perceived usefulness and it might be adjusted by their extent of confirmation. Surprisingly, BA continuous intention is not affected by perceived usefulness and technological compatibility. Whereas, the literature reported that technological compatibility and perceived usefulness

**Table 4** Summary of structure model evaluation

| Hypothesis | | Path Coefficient (β) | p-value | Hypothesis Validation |
|---|---|---|---|---|
| H1 | Confirmation → Perceived Usefulness | 0.770*** | 0.000 | Supported |
| H2 | Confirmation → BA Continuous Intention | 0.441*** | 0.000 | Supported |
| H3 | Confirmation → Technological Compatibility | 0.833*** | 0.000 | Supported |
| H4 | Perceived Usefulness → BA Continuous Intention | 0.169 | 0.062 | Not Supported |
| H5 | Technological Compatibility → BA Continuous Intention | 0.105 | 0.327 | Not Supported |

are the key drivers of continuance (Bawack & Ahmad, 2021; Ahmad et al., 2021; Gupta et al., 2020; Grubljesic & Jaklic, 2015; Bhattacherjee, 2001). However, in this study, we observe that technological compatibility and perceived usefulness have no effect on BA continuance in software and system development projects. One reason could be that generally employees or end-users do not make the strategic decision on choosing the BA technologies. The main challenge for BA project managers and decision-makers are to manage various stakeholders' expectations. The users would continue their BA use if it is compatible with their needs and expectations. These BA related expectations are reported as technologies robustness and highly responsive to user interactions (Larson & Chang, 2016; Viaene & Van den Bunder, 2011). This may also imply that the actual BA continuation intention is affected by users' work experience, needs and values.

### 5.1 Theoretical Implications

Our study offers several implications for the existing literature. Firstly, we empirically investigate factors affecting BA continuance in Pakistan and extends the body of knowledge at an organizational level. It is important to investigate the factors that contribute to the BA continuance in software projects. According to Shah et al. (2019), there is a link between rising adoption and failure of BA. The existing literature mostly focused on BA adoption and not on its continuance intention (Daradkeh, 2019). Secondly, this study identified the important enablers of BA adoption based on ECM. We looked into various factors from previous literature related to ECM and adapted them into the BA context of our study. Our findings show that confirmation influence perceived usefulness and technological compatibility as well as confirmation directly influence BA continuous intention. These results are in line with existing studies, which found that such factors are important for BA (Bawack & Ahmad, 2021; Ahmad et al., 2021; Chen et al., 2015; Jaklic et al., 2018; Viaene & Van den Bunder, 2011). On the other hand, technological compatibility and perceived usefulness do not influence the BA continuance.

Finally, this study comes under big data research (Abbasi et al., 2016; Mandal, 2019), in terms of assessing the BA initiatives at the individual and team level in the context of software projects. Our study provides a holistic view of BA continuance in software projects and sheds light on the factors that help to elaborate BA role in the management of software projects (Dennehy et al., 2020). Our amended ECM research model highlighted determinants for BA continuance and can be suitable to use in future studies with a similar goal. The confirmation factor provides a better understanding of the motivation of BA continuance in software projects especially in developing countries such as Pakistan.

### 5.2 Practical Implications

To maximize value similar to other technologies, BA continuance requires pervasive use and understanding of their expectations (Wixom et al., 2013). In this study, we reveal factors that influence the software and systems developers' continuance use of BA in their projects. Our study offers suggestions for the smooth use and adoption of BA in software and system development companies. From a managerial standpoint, the ECM provides useful insights. It is the managers' responsibility to pay attention to software and systems developers use behaviour to support BA continuance journey. Our study exhibits that perceived usefulness, technological compatibility and continuance intention are directly influenced by confirmation. The software and systems developers are more likely to perceive BA usefulness if their expectations are met. It may be prudent for managers to amplify BA users' prescriptive and predictive expectations because of its direct impact on BA continuance. For instance, the companies can observe individuals temporal personalities and perceptions to adopt BA tools functions accordingly. In this study, confirmation has a significant contributor to BA continuance. This implies that BA tools should be chosen based on software and systems developers needs and should not be disruptive to the existing way of working. To ensure BA continuance and continue to reap its benefits the managers needs to pay more attention to employees actual use experience and initial expectations. This study also reveals that confirmation influence perceived usefulness. This can be also implied that BA vendors need to carefully analyse the users' expectations and prior experiences. Further, it is important to meet users' expectations, be compatible with organizational values, and work practices. The individual users' expectations perspective is very important, as BA would affect their work performance. If the BA technology does not meet their expectations and disrupts their existing work, it might lead to undesirable outcomes. By considering users' expectations the manager could pick the best-fit BA for their organization that is aligned with their values and work practices. The managers need to be aware of the temporal characteristics of business analytics tools as they have a range of complexities. By taking into consideration, the adopted model constructs the software and systems development companies can improve the

environment for BA continuance. As a result, software and systems developers would be willing to use the BA in their work and their organizations attain its optimum benefits.

### 5.3 Limitations and Future Research Directions

In this study, we have several limitations that could be considered as a future research direction. Our study respondents were general software practitioners from Pakistan using BA in their projects. The study participants' recruitment was through direct contact of emails to different organizations. We intentionally selected the BA practitioners to obtain an appropriate data sample, as they had better understand BA and its use at work. This might lead to a biased perception regarding BA continuation intention. Nevertheless, such a diverse number of participants working in a range of projects and companies would be considered as a positive aspect of our study. We did not have any control over the type of participants in terms of their titles, job description and so on. Different organizational positions may have divergent views and varying knowledge about BA, factors that could affect the reliability of the results to some degree.

The respondents can be considered as individuals who are from different organizations and cannot represent the whole team or organization. Further, various stakeholders had different needs throughout the development project. For instance, a product owner may want to see different data than a software tester. This highlight the need for diverse information and investigation on stakeholder analysis. One BA tool is not a silver bullet and the consequence is that tool should support different views for product owners, managers, software testers etc. A multi-stakeholder experiences and perceptions investigation is essential. In the same vein, organizations and businesses need to understand a range of capabilities that are required for BA initiatives. These capabilities investigation might be circle around for instance people, processes, technology, organization and its culture. The temporal factor will bring more value to the BA research area if future research investigates it from various dimensions such as individual level, team level, and organization level. These dimensions are worthy of future research.

It is also worth noting that this study only focuses on the BA continuance in a single country i.e. Pakistan. Therefore, this study can be considered as BA use and continuance in companies in terms of Pakistani cultural aspects. This implies that Pakistani culture could have an influence on the outcomes of our study and may be considered as a limitation of this study. In future, it would be interesting to investigate such studies in various companies, business domains and countries. It would be worth investigating the BA under the existence of norms about time in organizations to explore differences in temporal norms among companies, workgroup types (such as managers, developers, designers etc.). This can be examined using Schriber's dimensions. A replication of this study in various contexts is also a direction for future investigations that will help to have more generalized results. The validation and modifying the research model presented in this research to include temporal complexities of the BA tools or analytics capabilities can also be an interesting adjustment worthy of pursuit.

The information and communication technology industry demand the current software engineering or information systems curriculum modification with an emphasis on both quantitative skills as well as software skills. In this regard, many universities around the globe offer analytics related courses in software engineering and information systems education. We believed that analysts using various analytics tools could be trained as part of software engineering or information systems curriculum. It will be good to consider the perspectives of graduates and obtain their opinions at different career stages. The result of such a study would help to obtain evidence of adjustment and offer opportunities for improvement of the current curriculums to meet the industrial demands.

## 6 Conclusion

This study examines Pakistani software professionals' BA expectations in software and systems development projects as well as their intentions to continue using BA technologies adopted by their respective organizations. In the information research stream, it is established that information systems continuance is dependent on its users' confirmation expectations. However, it is not evaluated in the context of Pakistan software professionals and their BA continuance in software and systems development projects. Our study uses ECM as a theoretical model, which highlighted that confirmation is a decisive factor of BA continuance intentions in software and systems development projects. In contrast to the ECM model, our findings show that perceived usefulness and technological compatibility factors do not contribute towards BA continuance intention in software and systems projects in Pakistan. The project managers need to pay attention that individuals will use BA tools when their actual use experience confirms their initial expectation. Such attention will yield to the maximization of value from BA investments. In summary, this study contributed towards the understanding of BA use in software and systems development projects and is expected to stimulate further research in a similar vein.

## Appendix 1

**Table 5** Study Questionnaire

| Constructs and item | |
|---|---|
| **BA Continuance Intention** (Bhattacherjee, 2001; Bawack & Ahmad, 2021) | |
| The extent to which a user intends to continue using BA; | |
| BAC1 | I intend to continue using BA rather than discontinue its use |
| BAC2 | I intend to continue using BA rather than any alternate means |
| BAC3* | If I could, I would like to continue my use of BA |
| **Confirmation** (Bhattacherjee, 2001; Bawack & Ahmad, 2021) | |
| The degree to which a user perceives the actual performance of BA to match their anticipated performance levels after BA use | |
| C1 | My experience with using BA was better than what I expected |
| C2 | The service level provided by BA was better than what I expected |
| C3 | Overall, most of my expectations from using BA were confirmed |
| **Perceived Usefulness** (Bhattacherjee, 2001; Bawack & Ahmad, 2021) | |
| The extent to which one expects to gain an operational or strategic advantage from using BA | |
| PU1 | Using BA improves my job performance. |
| PU2 | Using BA increases my job productivity. |
| PU3 | Using BA enhances my effectiveness in my job. |
| PU4 | Overall, BA is using in my job. |
| **Technological compatibility** (Chen et al., 2015; Bawack & Ahmad, 2021) | |
| The extent to which a BA consistently aligns with the needs, values and past experiences of its users | |
| TC1 | Using BA is consistent with our business practices. |
| TC2 | Using BA fits our organizational culture. |
| TC3 | Overall, it is easy to incorporate BA into our agile practices. |

*Reverse coded

**Funding** Open access funding provided by Karlstad University.

### Declarations

The authors have no relevant financial or non-financial interests to disclose.



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