



## The Effect of Big Data Analytics, Police Risk Management on Security Crisis Management: A Proposed Framework

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### ABSTRACT

An important area related to Police risk management and security crisis management is to undergo systemic risk modelling that estimates the interrelationships among different institutions, with the direction to establish the central tendency and focus on more related subjects. Big data analytics is intricately intertwined with other important concepts that fabricate many new advanced opportunities that were speculative in the past. This is a growing importance in the field of data-driven Police risk management and security crisis management. Extracting and utilising a huge amount of unstructured data is far from easy, and eventually, these data are linked to real-time events. Due to time and space constraints, the data need to be analysed in fewer passes, preferably in a single pass with sublinear space and time. This helps in the proper replanning and rescheduling of Police activities. Big data Analytics would make an impact in valuable knowledge gain for many Police organisations, which in turn benefited in Police risk management and security crisis management. The study aims to propose a framework for big data analytics, Police risk management and security crisis management. The study seeks to provide a guideline to the police in the UAE to understand the importance of Big data analytics, Police risk management in the security crisis management phase as it improves their operational performance.

### 1. Introduction

There are vital issues specifically related to the adoption of big data that must be addressed and acknowledged (Elyjoy, 2015). The rise of big data nowadays comes with many challenges, such as how organisations develop the necessary tools and methods for reacting to a crisis and misusing the vast amount of data for their advantage (Hassani and Silva, 2015). While new data technologies can develop police performance and law enforcement efficiency, concerns were raised regarding the way that police deal with big data (Alexander and Marion, 2020). Today, the literature still lacks enough data and information about what the police do to deal with security risks effectively (Worden et al., 2014). Despite that, the leaders of Dubai police established a new crisis management department in 2012 to deal with contingencies and critical security situations. However, until the present time, the assigned department for security crises still doesn't have enough details and evidence that big data analytics is an integral part of crisis management (Laufs and Waseem, 2020). The lack of empirical evidence on the role of big data analytics in policing lake of expertise to deal with big data law enforcement domain is the main barrier to the successful implementation of big data in policing (Alexander and Marion, 2020). To date, there is no common agreement on the best way to deal with security crises. Every country has its view and perspective on dealing with security crises. Security crises, e.g., intelligent leaks of confidential data that breach national security and stealing data that affect the safety of people in the country, must be addressed and managed properly and swiftly. Given the location of the UAE in the Middle East, security studies and scholars in this field have investigated the succession of possible threats to national security through a traditional lens; they have neglected the advancement in criminal methods that become very complicated and dependent on the latest technologies, including the utilisation of the internet to hack confidential data that may harm the national security of UAE and become a source of scrutiny crises (Guéraiche and Alexander, 2022).

Therefore, facing crises and raising awareness among public entities like police departments is necessary to avoid further materials and losses (Kamil, 2020). Often, the UAE national security crisis policy is analysed using standards from abroad, but it should be based on empirical evidence from local sources or surveys conducted by specialist agencies (Salisbury, 2020). In addition, despite the origin of crises that could be hard to identify for most people living in the UAE, the public views circumstances, not UAE police, as being responsible for continuing in any future crisis (Tariq, 2021). It is not clear to the present to what extent big data analytics and risk management contribute to security crisis management. This gap has not been reported yet in the UAE. In brief, the potential of Dubai police to use big data analytics and risk management to control a security crisis has not been reported in the past, and this scenario may give an ambiguous picture to the officials in the UAE government when developing guidelines and policies for security crisis management. The primary significance of this study is filling the gap in the literature concerning the role of risk management and big data analytics in law enforcement organisations and understanding the direct and indirect effects of big data analytics in police

departments. In addition to that, this study is the first attempt to develop a crisis management framework in police departments. Hence, the result of this study is expected to improve the performance of the Dubai police departments. The development of risk management in police departments will enhance security in the country and provide better protection to the citizens against security threats. Moreover, the findings of this study should bring advantages to government agencies in the UAE, especially those working in security fields and crisis management. This study studies the impact of Big data analytics, Police risk management on security crisis management, a very recent topic where only a few studies were conducted earlier.

## **2. Literature and Hypothesis Development**

A literature review on the diffusion of innovations (DOI) theory indicates that it can serve as a theoretical framework for studying factors shaping utilisation and the adoption of big data in developing countries. In crises, DOI proved to be a solid theory to explain how organisations use innovation to manage crises and risks (Alana & Sandra, 2021). This study deploys the DOI concept as a theoretical lens to offer a structure for the innovation process related to big data analytics and crisis management. DOI theory provides a framework for exploring how organisations practice and utilise innovations. Moreover, DOI explains the factors and processes influencing the adoption of innovations (e.g. big data analytics in law enforcement).

### *2.1 Big Data in UAE Police*

Big Data has been used in policing to improve the decision-making process in the daily operation of the police. A big-data-driven system that is used to dispatch police patrol cars accurately in a geographic environment has been widely used in developing countries like the UAE. For example, big data systems are used to allocate, in real-time, the nearest patrol car to the location of an incident or crime scene. In recent years, this system has been implemented and applied widely by the Abu Dhabi police (Oualid, 2014). The UAE is leading regionally in investments and hosting cloud data centres that represent the future infrastructure of the electronic government. Private and future technology sectors are based on big data at present, such as smart cities and self-driving cars, as well as the great benefits of these centres on the communications and information technology sectors in general, while police departments in UAE started to open new centres for big data analytics (Al-Khaleej, 2021). In this regard, Abu Dhabi police are keen to continue developing security and safety in the city, which confirms the critical role and approach in supporting Abu Dhabi to lead all cities in the world in the indicators of least crime cities for the fifth year in a row, through the continuous efforts made, to implement The principle of the rule of law, justice in all aspects of life, and tolerance among all residents, including citizens, residents and visitors (Al-Khaleej, 2021). In the same context, Dubai Police has taken the initiative to develop an integrated system for examining electronic evidence using the features of artificial intelligence and big data, which consists of a database of all electronic evidence issues that we deal with daily. Moreover, the police officers can rely on some advanced technical characteristics to speed up the processes used in analysing data related to various crimes, stressing that Dubai police is currently investing in artificial intelligence and advanced technology based on big data and harnessing them to serve the reality of investigating forensic evidence and detecting crimes (Desk, 2016).

The Dubai Police Force is renowned for accepting new technologies to enhance law enforcement and protect the local people and the Dubai community (Desk, 2016). Today, Dubai police are investing in big data for crime prediction; the predictive policing software of Space Imaging Middle East (SIME), now has Dubai police force use on a large scale. The software analyses existing intelligence and crime patterns from police databases and, using sophisticated algorithms and big data analytics, produces highly accurate data related to when and where crime is likely to occur next. The software, which is the first of its kind in the region, was developed in support of the UAE's Smart Governance Initiative and specifically designed to complement the Dubai Police Force's modernised approach to crime prevention and improved public safety. This intelligence informs patrol teams on which districts may require additional resources to prevent potential criminal activity.

### *2.2 Big Data Analytics*

Big data refers to both massive data sets and the instruments used to modify and analyse a vast volume of data. On the other hand, this term does not just refer to the information gathered from various sources; it also relates to the reasons behind the collected information. When data is gathered in bulk using algorithms to handle them (a set of instructions that tell a computer what to do), cross-reference data both inside and between datasets, and the computational software that processes the data finds patterns. Big data is essential for many applications related to law enforcement, such as predictive policing, which builds and discovers patterns in crimes (Daniel and Akwasi, 2019). Big data has started to permeate all facets of our lives, and there is an increased interest in the topic (Akter and Wamba, 2017). The UAE is leading regionally in investments and hosting cloud data centres that represent the future infrastructure of the electronic government. Private and future technology sectors are based on big data at present, such as smart cities and self-driving cars, as well as the great benefits of these centers on the communications and information technology sectors in general, while police departments in UAE started to open new centres for big data analytics (Al-Khaleej, 2021). In this regard, Abu Dhabi police are keen to continue developing security and safety in the city, which confirms the critical role and approach in supporting Abu Dhabi to lead all cities in the world in the indicators of least crime cities for the fifth year in a row, through

the continuous efforts made, to implement The principle of the rule of law, justice in all aspects of life, and tolerance among all residents, including citizens, residents and visitors (Al-Khaleej, 2021). In addition to that, in the field of law enforcement, big data analytics holds the potential to uncover previously unnoticed security-related patterns and reveal unanticipated hidden knowledge that could be the key to preventing future crimes or terrorist attacks (Aradau and Blanke, 2017). As a result, governments have made significant investments in big data collection systems and technology for acquiring and analysing data (Hollin, 2015). These facts reveal how critical big data analytics are for policing missions and the great support big data analytics can provide for police officers and all related police departments to predict crimes and manage security crises at the national level (Hand, 2009). Big data analytics is a multi-dimensional concept. Laney (2001) proposed that the three dimensions of big data are volume, variety, and velocity. The three Vs have been utilised as a common framework to describe big data (Gartner, 2015). In this section, the researcher will present the 3-Vs and other dimensions of big data provided by the computing industry as described below.

### *2.2.1 Data Volume*

The amount of data collected and generated by an organisation or an individual is referred to as volume. While 1 terabyte is presently the minimum size to qualify as big data, the minimum size to qualify as big data is a result of technological development. Currently, one terabyte contains enough data to fill 1,500 CDs or 220 DVDs, or roughly 16 million Facebook photos (Gartner, 2015). Unstructured data such as audio, pictures, and video is generated in large quantities by e-commerce, social media, and sensors. As more computing devices connect to the internet, new data is being added at an increasing rate. The rate at which data is generated and processed is referred to as velocity (Laney, 2001).

### *2.2.2 Data Velocity*

Data velocity rises over time. Due to the sluggish and expensive nature of data processing, firms initially evaluated data using batch processing systems. Real-time processing became the norm for computing applications as the speed of data production and processing grew. According to Gartner, (2015), there will be 6.4 billion connected devices in use worldwide in 2016, rising to 20.8 billion by 2020. Every day in 2016, it was predicted that 5.5 million new devices would be connected to collect, analyse, and share data. The increased data streaming capabilities of linked gadgets will further accelerate the velocity (Laney, 2001).

### *2.2.3 Data Variety*

The amount of data kinds is referred to as variety. Organisations can now generate structured, semi-structured, and unstructured data thanks to technological advancements. Unstructured data includes text, photos, audio, video, clickstream data, and sensor data, all of which lack the standardised framework essential for effective computation. Semi-structured data does not comply to relational database specifications, but it can be designed to fit the structural needs of applications. Extensible Business Reporting Language (XBRL), which was developed to share financial data between enterprises and government agencies, is an example of semi-structured data. Structured data is predefined and can be found in a variety of standard database types. Unstructured data is generated at a far faster rate than structured data as new analytics tools are developed, and the data type becomes less of an impediment to analysis. IBM added a fourth dimension, veracity, to highlight the unreliability and uncertainty inherent in data sources. Data incompleteness, inaccuracy, delay, inconsistency, subjectivity, and dishonesty cause uncertainty and unreliability (Laney, 2001).

## *2.3 Police Risk Management*

Risks exist in every area of life and almost all industries, the business world, public administration, and law enforcement. Thus, decisions must be made constantly to avoid risks using all possible means and technologies (Roman, 2020). Understanding uncertainty is essential to ensure the work is suitable. However, risk management as a discipline has been developed to help organisations identify and control risks through systematic approaches and practices. A risk in this context can be defined as a random event or incident that may or may not occur, so if it does occur, it would have an undesirable impact on the organisation's objectives or work (Vose, 2008). Different disciplines have different ways of classifying risks. Standard risk classification consists of three categories: 'known unknowns', 'known knowns', and 'unknowns. These three categories correspond to different levels of uncertainty (Jorion, 2009). Risk management is the process of identifying adverse events and estimating their likelihood of occurring with systematic preparation in advance. By running simulations and random variables with risk models, such as scenario tables, a risk manager can evaluate the probability of the best- and worst-case outcome, the threat occurring in the future, and the damage the organisation would experience, should this threat become true (Adam, 2021). Like any other profession in policing, risk management requires striking a balance between achieving goals and avoiding the inevitable security threats. Protecting the public and battling crime entails operational risk, and exposing anyone to high levels of personal risk, whether they are police officers, can lead to stress-related anxiety.

For many law enforcement agencies, risk management is a practice that seeks to identify and mitigate risk for both police officers and the public. It is essential to sustain the well-being of police officers and the public and ensure the integrity of the law enforcement institutions that protect and serve the community. Police officers engage in various risky activities every day, which involve several potentially threatening situations. Some risks are categorised at the organisational level,

such as financial (e.g. the high cost of crime control), and physical, such as occupational health (Adrian, 2014). The ultimate impact of these risks is not just facing police officers but could affect the whole police department. At the same time, the effect of security risks is not limited to those associated with policing but also extends outward to the citizens and justice seekers. Thus, RM practices are essential in law enforcement organisations to protect the people and police officers (Adrian, 2014). Risk identification, risk assessment, and risk management methods should be viewed as an excellent, albeit restricted, approach to improving the likelihood of identifying and avoiding future offending or victimisation (Alexander and Marion, 2020). Fully automated machine learning algorithms methods help police deal with risk and control crimes more effectively. However, the algorithms used in policing is only as good if the data used by these algorithms are accurate (Alexander and Marion, 2020).

### *2.3.1 Risk Identification*

Risks and uncertainties are two of the most widely used concepts in the project management literature (Adrian, 2014). Although these terms are closely related, many writers distinguish them (Alexander and Marion, 2020). It is also difficult for workers at risk to identify and distinguish them. The definition of risk or uncertainty regarding the use of a particular project is often adjusted. Roman (2020) suggested that the identification of risk is critical. He added that uncertainty is the intangible measure of what we don't know. Uncertainty is left behind when all the potential risks have been identified. Uncertainty is a gap in our knowledge that we may not even be aware of. Therefore, risk must be determined before establishing any projects.

### *2.3.2 Risk Analysis*

The second stage of the RM process is risk analysis, which involves analysing the data obtained concerning the potential risk. Risk analysis may also be defined as the process of selecting the chances that have the most significant influence on the work from all the threats identified during the identification phase (Alexander and Marion, 2020). In policing, risk analysis affords support for risk practices about how factors combine to increase the likelihood of crime occurrence (Kennedy, 2018). Conventional risk analysis methods tend to underestimate the probability and impact of risks (e.g. pandemics, financial collapses, terrorist attacks), as sometimes the existence of independent clarifications is wrongly assumed and cascading errors that can occur in complex systems are not considered (Roman, 2020). Risk analysis helps organisations to forecast the future with confidence; it is fundamental to predict uncertainties and reduce their incidence or impact. The adoption of risk management increases the likelihood of successful work completion and decreases its risks (Lavanya, 2008).

### *2.3.3 Risk Evaluation*

In general, there are two approaches to risk evaluation in the literature: (1) quantitative (2) qualitative. The first approach is based on data, whereas the second approach is based on interviews and brainstorming techniques (Beiler et al., 2016). It is vital that the most probable risk factors are effectively quantified in advance and next analysed before using a qualitative approach. Exposure to potential risks can result in delays, reduced productivity, and increased operating costs for many others. Many institutions are already adopting innovative ways to use big data analytical methods to improve their risk assessment processes and predict economic, social, or environmental data (Beiler et al., 2016). Risk evaluation is associated with practising insight into the dangers an organisation or staff faces in a specific location. A risk evaluation in the mission of law enforcement is a fundamental element and must be viewed as an integral part of the broader assessments involved in establishing operations or programs in any police department (Bickley, 2017). Evaluating the risk must not be a one-off event. A continuous re-evaluation of all possible risks will help ensure that you always have appropriate security measures in place. The risk assessment process first identifies the different security threats within a given context and how your staff, assets, the programs being implemented, or the organisation could be vulnerable. Evaluating risk according to likelihood and estimating the impact on the organisation to determine the degree of risk involved is one of the leading practices in RM. Moreover, the RM team identifies and assesses the different options that could be undertaken to manage these risks. Once mitigating measures are identified, there will still be some residual risk, which should be checked further to see if it is acceptable or not before moving to the next step. If a risk evaluation is carried out and all measures have been taken but not implemented, an organisation might be exposed to the risk again.

### *2.3.4 Risk Response*

This last stage in the process of RM indicates the actions to respond to the risk. The strategy and approach chosen for risk response depend on risk types (Vose, 2008). Risk response includes specific information and more details about the path taken to respond to the risk (Kennedy, 2018). The main requirement for risk response is that the risk manager must have adequate knowledge to respond to the risk (Kennedy, 2018). Some risk strategies for risk response include avoidance, reduction, transfer and possession (Bickley, 2017).. In addition to these types of reactions, Winch (2002) also describes how fast risk response should be in the typical case of RM. He suggested responding to the risk effectively, and it is essential to collect relevant information to prevent the risks. The literature review in this section indicates that RM is a multi-dimensional variable. The findings from previous studies reveal that RM can be measured through several dimensions. It is found that some dimensions are widely cited in the literature, such as risk identification, risk analysis,



risk evaluation, and risk response. In contrast, few studies identified other dimensions not well explained or quantitatively measured in studies associated with crisis management.

Thereby, the dimensional model of RM is illustrated in Figure 1.

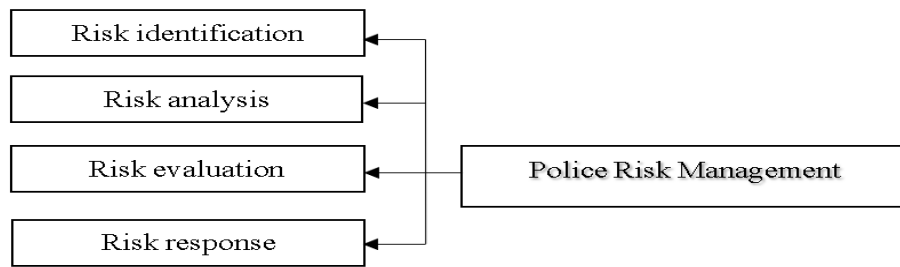


Figure: 1 The dimensional model of risk management in law enforcement

#### 2.4 Security Crisis Management

Security and crisis management establish a technique, system, and structure to protect people, property, and other assets from harm, loss, or criminal activity. This guarantees that police officers better grasp potential security risks and know how to respond to threats and safety emergencies. According to Khaddam (2014), crisis management has three principal stages: pre-crisis management stage, crisis management stage (during the crisis), and post-crisis management stage (after the crisis). In the same context, Bundy et al. (2017) provided a model that included five stages of crisis management, what the organisation must do at each step and the duties and tasks that must be worked out to be appropriate for each stage. As a result, the organisation now has the required information to do this assignment successfully. These steps will be regarded as dimensions of crisis management for this study:

#### 2.5 Detection Stage:

This refers to the stage before the start of the crisis. It is represented by the organisation's ability to respond to the warning signals that may cause the crisis, which includes taking preventive measures to prevent the crisis from occurring or, at the very least, reducing the severity and effects of the crisis if it does happen despite the organisation's efforts to avoid it, and discovering early warnings of crisis occurrence (Ahmed, 2010).

#### 2.6 Prevention Stage:

At this stage, organisations must develop an emergency plan to address the crisis and assemble a crisis management team with as much prior crisis management expertise as possible. This stage also entails identifying the organisation's weak points and devising a strategy to address them, as well as identifying the necessary methods and tools to assist in dealing with the crisis, training employees on how to deal with crises, learning from the mistakes of others, developing information about crises and expected problems, and assessing their skills in crisis management (Khaddam, 2014).

#### 2.7 Containment Stage:

At this stage, a set of actions to be taken is defined, communication processes within the crisis field are organised, the situation is stabilised, losses are reduced, the psychological and social effects of the crisis are addressed, and functional performance is improved in a more effective way than before. As a result, the plans are carried out by enforcing the order to deal with the problem, reducing the crisis, and finally utilising the organisation's resources (Saffar and Obeidat, 2020).

#### 2.8 Recovery Stage:

At this stage, the organisation's activity and operations are resumed. The organisation evaluates its loss and loss and assesses what is required to benefit from the activity and balance entirely. Human resources play an essential role in this process, as the organisation's human resources situation must be evaluated. What are the remaining capabilities of the organisation, and what are the assets used and exploited after knowing the resources (Saffar and Obeidat, 2020).

#### 2.9 Learning Stage:

Also known as the stage of drawing morals and lessons from prior crises to construct experiences capable of avoiding crises, preventing their recurrence, and standing at flaws, improving and avoiding them through the development and improvement process (Bundy et al., 2017). The nature and tasks of the crisis management team vary depending on the type of incidents/situations, their location, and the level of assistance necessary. One crisis management team member may perform multiple functions (Laari-Salmela et al., 2019). Additional support responsibilities, such as security, finance, insurance, legal counsel, social media, internal communications, and IT, may be necessary depending on the nature of the crisis and organisational capabilities. The literature review in this section indicates that crisis management is a multi-dimensional variable. The findings from previous studies reveal that crisis management can be measured through several dimensions. It is found that some dimensions are widely cited in the literature, such as crisis detection, crisis prevention, crisis containment, crisis recovery, and crisis learning. In contrast, few studies identified other dimensions not well

explained or quantitatively measured in studies associated with crisis management. Thereby, the dimensional model of crisis management is illustrated in Figure 2.

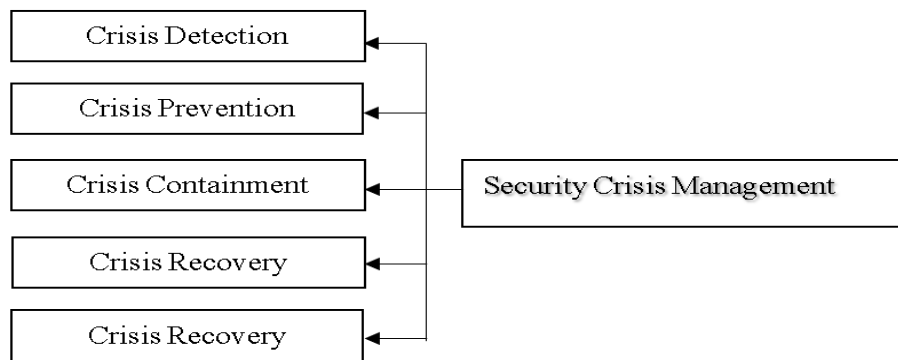


Figure: 2 The dimensional model of crisis management in law enforcement

### 3. Hypothesis Development

#### 3.1 The Relationship Between Big Data Analytics and Security Crisis Management

Crisis management systems are one of the big data roles, and machine learning can be used (Alpaydin, 2009). Scientists and analysts face one of the biggest challenges of managing large volumes of data generated during disasters and crises. Therefore, the role of big data in crisis management has evolved (Abderrazak et al., 2020). The literature revealed that big data analytics directly impacts crisis management in various fields and industries. Massive unstructured text big data, such as articles, blog posts, social media posts and comments, speeches, presidential inaugurations, and web platforms' documents through search engines, can be easily analysed with the development of analytical tools (Park, 2021). According to the theory of crisis management, big data can lead the direction of potential crisis management and has created opportunities for it to improve and control through the analysis of crisis information. There is great confidence that big data tools can be used to process large amounts of crisis-related data to provide insight into the fast-changing situation and help drive an effective disaster response (Qadir et al., 2016). Furthermore, it is necessary to prepare a crisis management strategy at the macro level in each country to respond to crises that bring about social change. In this regard, many scholars are focusing on using big data to read trends and agendas to discover insights into big data using various data mining techniques for responding to unknown crises and future events (Yun and Park, 2018; Abderrazak et al., 2020). Park (2021) study shows how a country can use big data analytics to detect “key social issues” and then make a subsequent strategy or decision-making system to develop a public communication or new policy in future events.

In addition to that, the effectiveness of big data analytics is essential to ensure unexpected situations are deemed destructive and harmful in political, economic, societal, or environmental affairs with security problems, mainly when they occur suddenly and unexpectedly, with little or no warning. Hence, it is necessary to prepare for a crisis management plan within a short time in a crisis that brings about social change (Qadir et al., 2016). Watson et al. (2017) presented findings from a case study of a big data roadmap and supported results from other studies that show that big data can contribute to crisis response efforts. They concluded that the increased usage of large datasets could positively affect preparation and response to crises and disasters, as well as massive data analytics. In the same context, Watson et al. (2017) suggested that big data analytics should be incorporated into the knowledge management process to improve the capability of data processing and crises. Their case study shows that the proposed knowledge management solution helps improve situational awareness and decision-making when dealing with social security incidents. At the same time, Doka et al. (2017) found a strong association between big data applications and crisis control, especially crises associated with riots in the community. Based on the empirical results and findings from previous studies. This study assumes that big data analytics and security crisis management are linked. This association suggests that big data analytics directly affects security crisis management. Build upon the above explanation. The hypothesis is formulated as follows:

*Hypothesis: 1 “Big data analytics has a significant effect on security crisis management.”*

#### 3.2 The Relationship Between Big Data Analytics and Police Risk Management

Some scholars suggested that big data and predictive analytics cannot ensure that all critical problems are avoided before they occur. However, big data analytics can provide more accurate early-warning indicators to prevent and reduce risks (Dahleh et al., 2016; Nyman et al., 2018). Hence, the adoption of big data analytics in risk management can create an essential competitive advantage for organisations. However, the direction of a highly variable amount of data in real-time requires new tools and methods and the broadening of IT, statistical and mathematical knowledge, mainly oriented to quantitative data analysis to interpret and transform it into high added-value information. The ongoing tracking of

discrimination risk is needed at all stages of a police data analytics project, from problem formulation and tool design to testing and operational deployment (Alexander and Marion, 2020). The amount of data acquired through digital technologies and multi-channelling with the adoption of big data analytics could support the maximisation of global business value thanks to the alignment of strategic priorities for risk management activities, the timely reporting of sources of uncertainty on which to focus attention, and the implementation of specific actions to improve performance (Nyman et al., 2018).

Additionally, the complexity of the police mission poses a considerable challenge for risk analysis and forecasting. Conventional risk analysis methods in law enforcement tend to underestimate the probability and impact of risks (e.g. pandemics, terrorist attacks), as sometimes the existence of independent observations is wrongly assumed and cascading errors that can occur in complex systems are not considered (Roman, 2020). Big data analytics offer substantial opportunities for improving risk management but may not replace the significance of appropriate assumptions, adequate data quality and continuous validation (Nyman et al., 2018). Although there are different understandings as to whether or not the main methods of risk management for large amounts of data are similar to conventional methods, it is widely considered that the availability of big data analytics allows novel risk management (Roman, 2020). This study will validate the following hypothesis statement based on the previous findings.

*Hypothesis 2: “Big data analytics has a significant effect on police risk management.”*

### *3.3 The Relationship Between Police Risk Management and Security Crisis Management*

Crisis management is not necessarily the same thing as risk management. Risk management involves planning for events that might occur in the future, while crisis management involves reacting to adverse events during and after they have occurred (Adam, 2021). As explained earlier, risk refers to the probabilistic likelihood that a crisis may happen and its (often economic) impact. Therefore, the risk is always linked to crises (Zamoum and Gorpe, 2018). The increasing number of crises of all kinds requires preventive measures. One of the elements is risk management in crisis management (Skomra, 2017). Effective risk management can prevent an issue from becoming a crisis. Poor understanding and management of risks can lead to a crisis (COMCEC, 2017). In addition, crisis management is the activity of public administration bodies, which is part of the national security management of every country. Therefore, risk management is an essential process for robust security crisis management. In contrast, the security law is developed to prevent crises, prepare to take control of them with planned actions, respond to emergencies, remove their effects, and restore resources and critical infrastructure. Various government documents in European countries often refer to the connection between risk management and security crisis management.

The significant effect of crises is well known even in the security sector, especially the police (Tariq, 2021). Hence, to foster crisis management in policing, risk management is one of the main requirements to achieve this goal. In crisis management, risk management has been conceived mainly as a proactive pre-crisis management effort deployed for crisis prevention and preparedness efforts (Coombs, 2015). Thus, organisations should continually identify, manage and communicate risks to key stakeholders during the different phases of crisis management (Ndlela, 2019). In addition to crisis preparedness, risk assessment can inform other phases of the risk management cycle, including vulnerability reduction through long-term territorial management, infrastructures and other policies, as well as disaster risk financing strategies. It can constitute a fundamental tool to harmonise risk management policies and practices across its various components with an overall coherent vision of priorities (Charles, 2013).

In brief, crises are often characterised by uncertain elements and create new risks for the organisations involved. Uncertainty surrounding the crisis circumstances poses many risks and significantly intensifies risk variables anchored around the probability of the event causing harm and the consequence of that harm (Zamoum and Gorpe, 2018). In other words, the crisis necessitates the identification of possible risks (including all types of threats and stakeholders associated with the crisis). After identifying and analysing the risk issue, the organisation must decide how it intends to frame the issue (Ndlela, 2019). The previous findings show that the adoption of crisis management alone is not enough without adequate risk management. Still, this relationship has not been examined in the law enforcement domain/ Therefore, this study will investigate the following hypothesis to understand the connection between risk management and security crisis management in policing missions.

*Hypothesis: 3 “Police risk management has a significant effect on security crisis management.”*

### *3.4 The Mediation Role of Risk Management*

The literature review shows that risk management, crisis management, and big data analytics are linked. However, how risk management interacts with big data analytics and security crisis management in policing missions arises. Risk management is critical for any organisation, and in the big data era, analytical tools for risk management are evolving faster than ever (Ozgun et al., 2020). Facts showed that risk management and big data analytics could identify new risks from data patterns for effective risk management strategies and better crisis management in departments responsible for security decision-making. One of the main benefits of big data analytics is having a better risk management strategy that draws from large data sample sizes (Bakdash and Marusich, 2015; Buchanan, 2019). Although police may be rich in data, they still need to improve the extraction of information and knowledge from that data and use it to decrease crime and

strengthen clearance rates (Ridgeway, 2018). At the same time, risk analysis provides evidence-based support for risk narratives about how factors combine to increase the probability of crime occurrence (Kennedy et al., 2108). Thereby, risk management influences the relationship between big data analytics and crisis management. Nevertheless, the mediation role of risk management in this association has not been examined empirically in the context of law enforcement. Based on this claim, this study will verify the following hypothesis statement.

*Hypothesis: 4 “Police risk management mediates the relationship between big data analytics and security crisis management.”*

#### 4. The Proposed Framework

This study deploys the DOI concept as a theoretical lens to offer a structure for the innovation process related to big data analytics and crisis management. DOI explain how an organisation uses innovation to communicate within the organisation and the public. For example, police departments use innovative tools such as big data analytics to serve the public in specific crises and big events. The DOI Theory helps provide an account of how technological innovations such as big data move from the stage of the invention to widespread use or not (Elyjoy, 2015). To develop a framework to identify the main factors affecting the organisational adoption of big data, DOI is a robust theory to enhance practitioners’ understanding of the decision-making processes involved in a firm’s adoption of big data (Shiwei et al., 2018). A literature review on the DOI Theory indicates that it can serve as a theoretical framework for studying factors shaping utilisation and the adoption of big data in developing countries such as the UAE. DOI is very comprehensive, and its concepts are very relevant to technology adoption in developing countries (Roman, 2004; Aleke et al., 2011; Richardson, 2009). Therefore, the conceptual framework of this study is designed to explain how the innovation diffusion through big data analytics in law enforcement organisations could foster security crisis management with the mediation influence of police crisis management.

The framework that is developed in this study constructs one independent variable (big data analytics), one mediator (police risk management), and one dependent variable (security crisis management). The conceptual framework is a body of interconnected fundamentals and objectives. This framework will be evaluated based on quantitative methods and statistical analyses. Hence, this study aims to identify the impact of big data analytics on security crisis management and the underlying police risk management that achieves the objectives of the police mission in UAE. Those concepts will guide the Dubai police headquarters on how the diffusion of innovation in the big data domain can support security crisis management in the future.

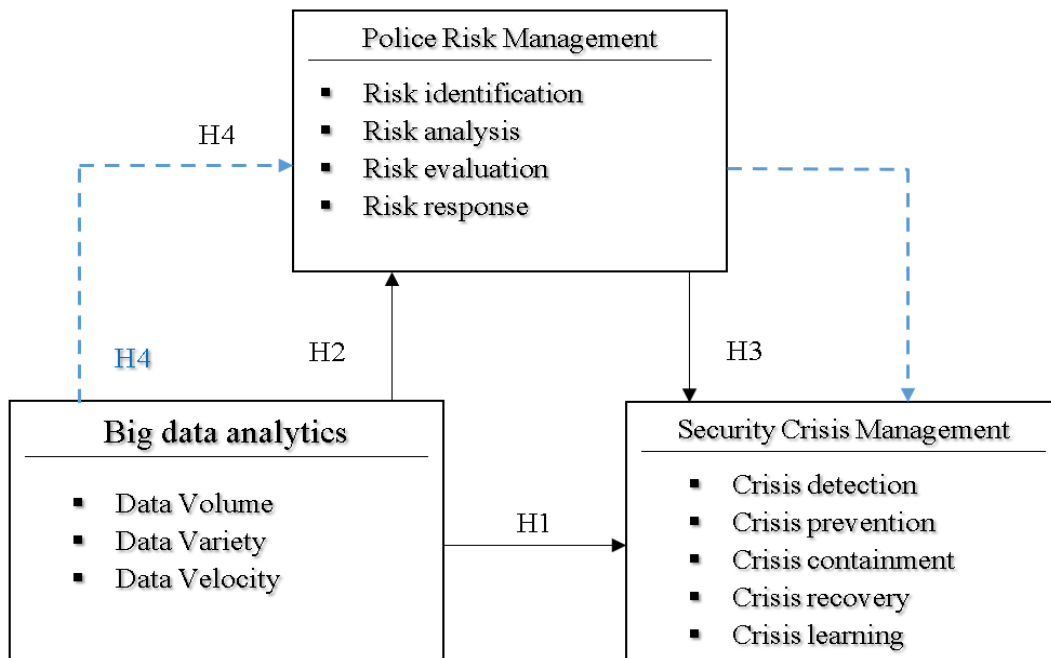


Figure: 3 Study Framework

#### 5. Discussion and Conclusion

The literature review provides lots of evidence on improving crisis management using big data and machine learning (Abderrazak et al., 2020). Still, the role of risk management in this relationship was not tested empirically on a large scale, while there is a lack of studies in the law enforcement and policing domain. Some scholars have referred to the need to develop an innovative theory that can be applied during extraordinary and unprecedented disasters and crises (Dillette



and Ponting, 2020). While the development of policing algorithms based on big data analytics is often not supported by robust empirical evidence, studies in this field claim that a thorough case study is often absent (Alexander and Marion, 2020). There is a need to develop “big data” models for collecting and interpreting law enforcement agency and national data sets that can be used to identify and analyse risk (Copple and James, 2018).

Moreover, big data analytics as a study discipline is still evolving and not yet established. Thus, understanding the phenomenon and the variables that interact with big data and crisis management still needs more investigation and in-depth quantitative analysis. At the same time, a framework that correlates big data analytics, risk management, and crisis management is yet to be established. The actual progress made in big data analytics revealed a lack of management study in the field and a distinct lack of theoretical constructs and academic consistency, which may be a function of an underlying methodological rather than an educational challenge. In other words, there has also been a lack of study studies that broadly address the critical challenges of big data in the UAE or investigate opportunities for new theoretical models (George et al., 2014). Thus, studies in this field should identify the big data challenges and associate big data analytics methods with crisis management to understand how these two variables are associated (Uthayasankar et al., 2017). It is important to note that the availability of big data alone does not stop a crisis or provide complete protection from its consequences (Bacon, 2013). A good example is the existence of a vast amount of data on earthquakes, but there is a lack of a consistent model that can precisely predict earthquakes (Silver, 2012). Some existing studies found that the challenges of crisis management are related to a hypothesis, testing and frameworks utilised for big data predicting (Poynter, 2013), whilst West (2013) recognised more concern on the absence of theory to complement big data in a wide range of industries. Besides, the diverse challenges linked to predicting big data should be given more consideration (Hassani and Silva, 2015). Based on the previous claims, this study will examine the role of risk management in the direct relationship between big data analytics and crisis management for the first time in law enforcement agencies in the UAE.

This study describes, evaluates, and reflects on the literature on big data analytics in law enforcement. To combine the disparate debate on big data, the researcher first defined what big data meant and identified its main challenges. The focus of the study has been on using big data analytics to generate meaningful and valuable insights from massive data so that crisis management in policing would be more effective. The researcher emphasises that big data analytics, which primarily deals with extensive structured and unstructured data, is essential to improve police risk management and security crisis management. In brief, the discussion in this study reveals that developed police departments that rely on innovation looked into text, audio, video, and social media data analytics to enhance policing in times of crisis and predictive analytics of future crimes. The study argues that new statistical techniques for extensive data are needed to overcome the differences between big data and smaller data sets. Most current statistical approaches were developed for smaller data sets made up of samples. In brief, breakthroughs in big data analytical approaches have yet to occur. Such novel analytics are expected to appear soon. Because of the rise of location-aware social media and mobile apps, real-time analytics will undoubtedly become a burgeoning topic of study in the future. Because big data is so huge, interconnected, and unreliable, statistical techniques that are more efficiently suited to mining big data while sensitive to distinctive characteristics are likely to emerge. The enormous volumes of less ‘trustworthy’ data could yield further significant insights.

## REFERENCES

- Abderrazak B., Mahmoud E., & Mahmoud Nassar. (2020). Crisis Management Systems: Big Data and Machine Learning Approach. ENASE 2020 - 15th International Conference on Evaluation of Novel Approaches to Software Engineering, 603-610.
- Adam, H. (2021). Crisis Management. <https://www.investopedia.com/terms/c/crisis-management>.
- Adrian, C. A. (2014). Risk management issues in policing: from safety risks law enforcement agents face to occupational health. *Procedia Economics and finance*, 15(2), 1671-1676.
- Akter, S. & Wamba, S. F. (2017). Big data and disaster management: a systematic review and agenda for future research. *Annals of Operations Research*, 1–21.
- Aleke, B., Ojiako, U., & Wainwright, D. W. (2011). ICT adoption in developing countries: perspectives from small-scale agribusinesses. *Journal of Enterprise Information Management*, 24 (1), 68-84.
- Al-Khaleej. (2021, July 13). UAE attracts international companies to invest in data centers.
- Al-Khaleej. (2021, May 29). Abu Dhabi Police: Foresight for the future enhances security and safety.
- Alpaydin, E. (2009). *Introduction to machine learning*. MIT press.
- Aradau, C. & Blanke, T. (2017). Politics of prediction: security and the time/space of govern mentality in the age of big data. *European Journal of Social Theory*, 20(3), 373-391.
- Bacon, T. (2013). Big bang? When Big Data gets too big. <http://www.eyefortravel.com/mobile-and-technology/big-bang-when-%E2%80%98big-data%E2%80%99-gets-too-big>. (Accessed 16 May 2021).
- Bakdash, J. & Marusich, L. (2015). Risk analysis in big data. Available from: SSRN 2641726.
- Bickley, S. (2017). Security Risk Management: a basic guide for smaller NGOs. European Interagency Security Forum (EISF).
- Buchanan, M. (2019). The limits of machine prediction, *Nat Phys*, 15, 304.
- Bundy, J., Pfarrer, M. D., Short, C. E., & Coombs, W. T. (2017). Crises and crisis management: Integration, interpretation, and research development. *Journal of Management*, 43(6), 1661–1692.
- Charles, Baubion. (2013). OECD Risk Management: Strategic Crisis Management. OECD Working Papers on Public Governance, 23.
- COMCEC Coordination Office. (2017). Risk & Crisis Management in Tourism Sector: Recovery From Crisis in the OIC Member Countries. [https://www.sbb.gov.tr/wp-content/uploads/2021/02/Risk\\_and\\_Crisis\\_Management\\_in\\_Tourism\\_Sector.pdf](https://www.sbb.gov.tr/wp-content/uploads/2021/02/Risk_and_Crisis_Management_in_Tourism_Sector.pdf)
- Coombs, W. T. (2015). *Ongoing Crisis Communication. Planning, Managing, and Responding* (4th ed.). Los Angeles: Sage.
- Copple, C. K., & James, E. C. (2018). Risk management in law enforcement: discussions on identifying and mitigating risk for officers, departments, and the public. Washington, DC: Office of Community Oriented Policing Services.

- Dahleh, M., Ozdaglar, A., Lo, A. W., Bruce, E., Wilbur, J. (2016). Workshop on data, analytics, and risk in finance summary report, MIT Institute for Data, Systems, and Society, Cambridge (MA), 1-10.
- Desk, N. (2016). Dubai police launches policing software for crime prediction. GEOSPATIAL WORLD.<https://www.geospatialworld.net/news/dubai-police-launches-policing-software-crime-prediction/>
- Dillette, A. and Ponting, S.S.A., 2021, June. Diffusing innovation in times of disasters: considerations for event management professionals. *Journal of Convention & Event Tourism*, 22(3), 197-220.
- Doka, K., Mytilinis, I., Giannakopoulos, I., Konstantinou, I., Tsitsigkos, D., Terrovitis, M., and Koziris, N. (2017). Exploiting social networking and mobile data for crisis detection and management. In *International Conference on Information Systems for Crisis Response and Management in Mediterranean Countries*, Springer, 28–40.
- Elyjoy, M. (2015). Diffusion of Big Data and Analytics in Developing Countries. *The International Journal Of Engineering And Science (IJES)*, 4(8), 44-50.
- Gartner. (2015). Gartner says 6.4 billion connected things will be in use in 2016, up 30 percent from 2015. Retrieved from <http://www.gartner.com/newsroom/id/3165317>.
- George, G., Haas, M. R. & Pentland, A. (2014). Big Data and management. *Academy of Management Journal*, 57(2), 321-326.
- Guéraiche, W., & Alexander, K. (Eds.). (2022). *Facets of security in the United Arab Emirates*. Routledge.
- Hand, D. J. (2009). Mining the past to determine the future: problems and possibilities. *Int J Forecast*, 25(3), 441–451.
- Hassani, H. & Silva, E. S. (2015). Forecasting with big data: a review. *Ann Data Sci*, 2, 5-19.
- Hollin, R. (2015). Chapter 2 - Drilling into the big data gold mine: data fusion and high-performance analytics for intelligence professionals, B Akhgar (editor), *Application of Big Data for National Security*, Butterworth-Heinemann, Oxford, UK, 14-20.
- Jorion, P. (2009). Risk management lessons from the credit crisis, *Eur Finan Manage*, 15, 923-33.
- Kamil, A. (2020). Role of public relations in crisis management with the coronavirus crisis as an example: A case study on the UAE. *Global Media Journal*, 18(35), 1-6.
- Kennedy, L. W., Caplan, J. M., & Piza, E. L. (2018). The evolution of modern policing. In *Risk-Based Policing: Evidence-Based Crime Prevention with Big Data and Spatial Analytics* (first Ed.). University of California Press, 11-22.
- Kennedy, L. W., Caplan, J. M., & Piza, E. L. (2018). The evolution of modern policing. In *Risk-Based Policing: Evidence-Based Crime Prevention with Big Data and Spatial Analytics* (first Ed.). University of California Press, 11-22.
- Khaddam, A. (2014). *Integration of Management Information Systems and Knowledge Sharing and their Role in Crisis Management (A field study in Jordanian cellular telecommunications companies)*, unpublished PhD thesis, Jinan University, Lebanon.
- Konikoff, D. and Owusu-Bempah, K., 2019. Big data and criminal justice—What Canadians should know. Broadbent Institute.
- Laari-Salmela S., Mainela T., Puhakka V. (2019). Resolving the start-up identity crisis: Strategising in a network context. *Industrial Marketing Management*, 80, 201–213.
- Laney, Doug. (2001). *3D Data Management: Controlling Data Volume, Velocity, and Variety*. Stamford, CT: META Group.
- Laufs, J. & Waseem, Z. (2020). Policing in pandemics: A systematic review and best practices for police response to COVID-19. *International journal of disaster risk reduction: IJDRR*, 51, 101812.
- Ndlela, M. N. (2019). *A Stakeholder Approach to Risk Management*. In: *Crisis Communication*. Palgrave Pivot Publisher, Cham.
- Nyman, R., Kapadia, S., Tuckett, D., Gregory, D., Ormerod, P., & Smith, R. (2018). News and narratives in financial systems: exploiting big data for systemic risk assessment, Bank of England, Staff Working Paper, 704,
- Oualid, W. B. A. (2014). Big Data-Driven Smart Policing: Big Data-Based Patrol Car Dispatching in Abu Dhabi, UAE World Academy of Science, Engineering and Technology International Journal of Aerospace and Mechanical Engineering, 8(12).
- Ozgun, M., Araz, Tsan-Ming Choi, David L Olson, F. Sibel Salman. (2020). Role of Analytics for Operational Risk Management in the Era of Big Data. *Decision Science*, 51(6), 1320-1346.
- Park, Y. E. (2021). Developing a COVID-19 Crisis Management Strategy Using News Media and Social Media in Big Data Analytics. *Social Science Computer Review*.
- Poynter, R. (2013). Big data successes and limitations: what researchers and marketers need to know. <http://www.visioncritical.com/blog/big-data-successes-and-limitations>. (Accessed 20 Nov 2022).
- Qadir, J., Ali, A., ur Rasool, R., Zwitter, A., Sathiaselan, A., & Crowcroft, J. (2016). Crisis analytics: big data-driven crisis response. *Journal of International Humanitarian Action*, 1(1), 1-21.
- Richardson, J. (2009). Diffusion of technology adoption in Cambodia: The test of a theory. *International Journal of Education and Development using Information and Communication Technology*, 5 (3), 157-171.
- Ridgeway, Greg. (2018). Policing in the Era of Big Data. *Annual Review of Criminology*, 1.
- Roman, Kernchen. (2020). Risk Forecasting in the Light of Big Data. *Journal of Risk Analysis and Crisis Response*, 10(4), 160-167.
- Roman, R. (2004). Diffusion of Innovations as a Theoretical Framework for Telecenters. The Massachusetts Institute of Technology. *Information Technologies and International Development*.
- Saffar, N., and Obeidat, A. (2020). The effect of total quality management practices on employee performance: The moderating role of knowledge sharing. *Management Science Letters*, 10(1), 77-90.
- Salisbury, P. (2020). Risk Perception and Appetite in UAE Foreign and National Security Policy. Royal Institute of International Affairs.
- Shiwei Sun, Casey G. Cegielski, Lin Jia & Dianne J. Hall (2018) Understanding the Factors Affecting the Organizational Adoption of Big Data, *Journal of Computer Information Systems*, 58:3, 193-203.
- Silver, N. (2012). *The signal and the noise: the art and science of prediction*. Penguin UK.
- Skomra, W., 2017. Risk management as part of crisis management tasks. *Foundations of Management*, 9(1), pp.245-256.
- Tariq, S. K. B. A., Ahmad, Bashawir A. G., & Mohammed R. A. S. (2021). The Crisis Management and the Reputation of UAE Police: An Application Situational Crisis Communication Theory. *Turkish Journal of Computer and Mathematics Education*, 12(3), 2959-2968.
- Uthayasankar Sivarajah, Muhammad Mustafa Kamal, Zahir Irani, Vishanth Weerakkody. (2017). Critical analysis of Big Data challenges and analytical methods, *Journal of Business Research*, 70, 263-286.
- Vose, D. (2008). *Risk analysis: a quantitative guide*. John Wiley & Sons, Chichester, 1-729.
- Watson, H., Finn, R. L., and Wadhwa, K. (2017). Organisational and societal impacts of big data in crisis management. *Journal of Contingencies and Crisis Management*, 25(1), 15-22.
- West, G. (2013). Big data needs a big theory to go with it. <http://www.scientificamerican.com/article/big-data-needs-big-theory/>. Accessed 31 May 2023.
- Worden, R., Harris, C., & Mclean, S. (2014). Risk assessment and risk management in policing. *An International Journal of Police Strategies and Management*. 37.
- Yun, E., Park, Y. (2018). Extraction of scientific semantic networks from science textbooks and comparison with science teachers' spoken language by text network analysis. *International Journal of Science Education*, 40(17), 2118–2136.
- Zamoum, Khaled & Gorpe, Tevhide. (2018). *Crisis management: A historical and conceptual approach for a better understanding of today's crises*. In *Crisis Management Theory & Practice*. Edited by Kattarina Holla, Michal Titko and Jozef Ristvej. London: IntechOpen Limited, 203-217.