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Editorial to Issue 43(1)

As Vickers pointed out, "Human systems are different" (Vickers, 1983). A system can be described as a set of perceived relationships among some elements that together form an integrated whole, subject to some kind of sustaining regulator. The whole may be a part of some wider system(s) and similarly, the elements themselves may participate in other systems. Vickers contrasts three types of system with which human beings have to do. The ecological model develops through interactions among life forms (possibly including human beings) in a particular environment that is to some extent created by them, and sustained by their interacting forces. Ecological systems have *outcomes.* which can impact upon human beings and other life forms, but these outcomes do not constitute *purpose*, and cannot be regarded as being either successful or unsuccessful. They do, however, yield potential for purposeful intervention using human ingenuity. Thus, a prairie on which lush grass is growing may become a farm growing crops desired by someone who intervenes to change ecological relationships. Judgment of the success of such interventions is likely to be problematic; outcomes that favour some life forms may be challenging to others. Vickers discusses the concept of purpose in relation to human systems. Sometimes we assume that a purpose is worth pursuing for its own sake, but often goals relate to a more remote end. When human judgment is exercised in defining *purpose*, it is sometimes the case that *means* are subsumed, so that they are not evaluated except insofar as they are helpful or unhelpful to the efficient achievement of purpose. The exercise of human judgment can become disguised, as *purpose* dominates, and judgments become isolated from actions. This has been observed when technologies are harnessed as a means to achievement of purpose. Responsibility is then handed over to experts, who are not participants in the processes of judgment and evaluation.

Vickers highlights criteria that may be linked to human judgments of *success* of purposeful systems. At one level, actions may be compared to intentions. A political campaign is judged successful if the preferred candidate is elected, or possibly if the rival candidate's reputation is smeared so that he is compelled to withdraw. However, since criteria are structures of a human mind, consideration of all possible outcomes in relation to criteria conceived by all who are affected by them is likely to lead to conflicting judgments of *success.* Thus, purposeful systems may be ascribed a political dimension. Uncertainties

inherent in purposeful activities may lead to perceptions of risk, which may be more or less acceptable to judgments of different people. Furthermore, the time horizon considered will affect judgments. While some purposeful systems are ephemeral in nature, others involve choices that will impact upon future stakeholders. We are seeing today that choices made in the past about energy consumption and waste disposal are, in the long-term, impacting upon the viability of ecological system on which humanity depends. Cultural norms and values can also change over time, affecting judgments of success or failure. The second amendment to the United States Constitution would have received near universal approval among people who had migrated away from oppressive regimes elsewhere and desired security. Today, there is more diverse opinion as to how a "well-regulated militia" can best be achieved.

Vickers draws attention to the distinction between human and man-made systems. The latter are considered to serve a human purpose by design. While not divorced from human judgment, or completely technological, they may be distinctive in being automatic. Human systems, on the other hand, while they may be brought into being through an element of design and may include man-made systems within them, are not wholly purposeful. As Vickers puts it "*People are not merely instruments either of other people's purposes or even of their own*" (p.214).

Ackoff pointed out that the rate of change of technology has been increasing (Ackoff, 1974). If this was true in the time when he was writing, it is more so now. Where once we might have drawn upon experience, or trial-and-error to reach a judgment about effectiveness of solutions or success of purposeful systems, nowadays we lack the necessary time to do so. Perception of issues, description of problems, consideration of alternatives all take time. As Ackoff puts it "*An increasing portion of society's responses are made out of desperations, not out of deliberation"* (1974, p.5). This leads once again to a greater reliance on experts who may understand technologies and their application. These experts may, in turn, relay upon some set of norms known as 'best practice' in their field. Designers of technical systems are often enjoined to consider the interests of 'the user', but which of us identifies as a user of technologies - rather than an accountant, an artist or a café owner? (Nissen, 2002). Could we genuinely engage with designers of man-made, technological systems to ensure that the purposes of our human systems continue to be served? Complexity of integrated business process software is now such that an opposite position may be adopted, that 'users' must adapt to the imperatives of the system. Added to this is the development of intelligent agents that can replace human actors in a process, since they have the capacity to 'learn' both via rules and episodically, from practice, to improve

performance. AI has been implemented, for instance, within the Swedish banking system. As bricks-and-mortar branches are removed for efficiency reasons, customers still desire a personal service and meaningful interaction with their banks. Conversational commerce, as it is called, is supported by incorporating intelligent agents within customer-facing processes (Bhattacharyya, 2017). This, it is suggested, frees human agents for those interactions requiring experience and judgment. However, where does this experience co, me from, moving forward, if all routine work has been devolved upon AI. What are the foundations of for judgment as systems evolve and are redesigned?

Of course, as Vickers pointed out, not all man-made systems relate to advancing technology. In companies, managers spend time and effort in devising policies and strategies to direct future practice in the hope of achieving success in particular purposeful systems. Much of our time as Systemists is taking up in research to devise tools, techniques and methods that we hope will assist us to see phenomena in and behaviour from a holistic perspective. Still more time is taken up engaging with real world situations in which we apply these, and other models, in efforts to intervene to bring about positive change. Here again, it is important that we focus upon the exercise of human judgment. As Ciborra pointed out (2002, p.7) it is possible to become enamoured of the latest management 'fad' – e.g. it Business Process Reengineering, Soft Systems Methodology or Prince2 – and focus on their application so that we may miss more nuanced aspects of behaviour among workplace actors. As Jim Scholes points out in his forthcoming discussion of consultancy practice (Scholes, 2022), clients never employ him to apply the Soft Systems Methodology – they employ him to help them address a problem or issue they are experiencing, using whatever appropriate means are at his disposal.

The purpose of this discussion has been to highlight the continuing importance of human judgment. We may reflect that it is possible to delegate to other agents the authority to carry out tasks on our behalf, but that it is not possible to delegate the responsibility. It is important that we remember this, whether we are talking about human or man-made systems. Now that we have very clever technologies that can participate in our purposeful human systems, the act of judgment of success or failure in their behaviour must be retained by us.

There are three papers in Issue 43(1) of Systemist. The first is a position piece by our Editor-in-Chief, Professor Frank Stowell, entitled 'The Value of Systemist'. He discusses the changing technologies that have been used in producing and disseminating the Journal during its 45 years of publication, and reflects upon the dominance of software solutions within publishing generally.

Does the power of software in the hands of publishers serve to shape how ideas are formed and disseminated in the 21st century?

The second paper, by Abuka Emmanuel I., E.O. Osaghae and Frederick Duniya Basaky, sets out a discussion of the benefits to be achieved from one particular application of Artificial Intelligence in the field of poultry farming in Nigeria. Significant gains in agricultural productivity have become possible in recent years, as monitoring can be done using systems that can survey flocks and are capable of reasoning, learning and communicating.

The final contribution in this Issue comes from Debbie Sadd and Gary Evans, who give an account of development of a new framework for assessing major events, which is informed by systems thinking.

Christine Welch, September 2022

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The Value of Systemist – a Discussion

Prof. Frank Stowell
University of Portsmouth, UK, email: frank.stowell@port.ac.uk

Editor-in-Chief, Systemist

Systemist began life as a newsletter circa 1977 shortly after UKSS (http://www.systemsforum.org) was born. That is about 45 years ago. It was edited by Mike Jackson and Paul Keyes for a few years then Paul Ledington until he emigrated to Australia then, yours truly since, about 1989. When I took on the task, I changed it from a few sheets of A4 into an A5 sized booklet. We called it 'The Publication of the UK SS'. It was a primitive exercise in the early days, for example, page numbers were added using Letraset, the finished article was put into brown envelopes. Daune West and I walked to the post office to buy the right value stamps for each individual envelope and, painstakingly stick them onto close on 300 membership copies. A post office clerk took pity on us and loaned us a little container with a damp piece of sponge inside with which to stick the stamps, this was a boon. It was a time-consuming task and one we did for several years. The cover was light blue (Systemist blue) designed by Daune's father, an art teacher. The colour and design have remained the same ever since, although the size of the journal 'Systemist' as it has now become is a standard size for a journal of this type. Members told me that they liked the sound of the Systemist dropping on their door mat which reminded them that the Society existed, and they were part of it

The UKSS board decided in the early 2000's that we should explore making Systemist into a commercial venture as the cost of publishing and postage was becoming prohibitive. The board decided that we should give up the hard copy and go 'electronic'. This proposal was passed by the membership at conference in 2014. After discussion with several publishers, we joined the IGI stable (https://www.igi-global.com/journals/) and launched the International Journal of Systems In Society in 2015. Importantly we retained the trademark 'Systemist' and its livery, which was included inside the IGI cover. The new journal worked well, and we had good relations with IGI who were keen to support societies like ours. But around 2017 I was informed that they were to adopt a new automated submission system. The first thing I realised was that the 'normal' relationship enjoyed by EiC and the publisher's editor would

change. The new computer-based submission system was introduced and at first nothing much changed, but soon the editor I worked with 'disappeared' (presumably moved elsewhere in the organisation or left) and she was replaced by a new group of 'editors' who did not seem to have the same level of expertise as the editors I had worked with in the past. It was soon clear that the way the journal was operated and the role of the EiC had changed. The relationship with the publisher, and that of the EiC seemed now to be subordinated to the software submission system. Many of our authors expressed discontent with the new submission system and I was concerned that the character of Systemist as a welcoming members journal would be eroded. The UKSS management committee decided that it was time to part company and revert to Systemist (which belongs to the UKSS). We had retained our ISSN number to which we added one for the soft version and we were quickly able to re-establish our link to the British Library where we send copies of each edition (hard and soft copies) of Systemist.

The point in writing this short history is that is links directly to the discussion in a paper published in the Systemist, (Systemist Vol. 42, No.2 Winter 2021, pp185-190) which I wrote in response to Professor Barile's keynote presentation at the WOSC conference in 2021. In his presentation Professor Barile argued that we have entered a period of dataism. We are becoming so reliant upon digital technology that there is a danger of it becoming an alternative 'real world'. In many areas we are substituting fundamental human relationships such as human to human communication and human contact with a digital go-between. Barile's point is well made and adds a modern interpretation of Sir Geffrey Vickers observation that science is '…not simply a development but rather a radical reconstruction of the naïve and natural world of common sense…' he continued '…The more I see of science and read of scientists, the more I feel that science has cramped the human spirit conceptually worse than all the dryads and demons put together.' Vickers (1991, p 8 and p53).

The publishing process is changing. Where once the EiC formed a partnership with the publishers assigned editor this has been replaced by staff who, might be called editors but effectively sit in front of a monitor running software checks based upon an algorithm, often adapted from a management monitoring system. The most popular admission software is 'Scholar one' owned by Clarivate (https://clarivate.com/about-us/) and in 2019 Springer Nature was expected to

sign an agreement with SPi global[1] (now called Straive - https://www.straive.com/contact-us). I note that Emerald is also deploying ScholarOne Manuscripts across their entire journal list; a single source across two major publishers.

Often the parent company provide software for a range of applications. For example, in the above case they say that they offer data services and subject matter expertise (SME) to industries such as publishing, finance, healthcare and life sciences, media and retail, research, learning, and corporates. Conceivably the same core software is used and adapted for a specific use such as academic journals. But as far as I am aware the introduction of this software is done with little or no discussion with the academics that support the journal, including the EiC, advisory panels and associate editors. It is effectively imposed. This was my experience at IGI.

There are many advantages of using a software-based submission system. Saving time and money being two. But the software it is not just checking in-text references, which we authors are often grateful for, but other things are being added. For example, one programme asks what proportion each author has contributed in a multiple authored paper. Although such a question most academics might find distasteful, authors have no alternative but to answer the question if they want the paper to get into the academic stage of the submission process. The software programme seems now to be dominating and, in some respects, determining policies that were once the province of the EiC and senior editors.

I have found when trying to get an explanation where the software has prevented progress is very difficult. Often the answer the author receives appears to be provided by an avatar. Once the question goes outside the limits of the algorithm it might be passed to a human, but even this contact is limited to what the 'computer says' kind of 'guidance'. To get beyond this is tortuous and even the most helpful EiC finds themselves hampered by the 'system'. We find echo's here with Barile's paper where he says we are moving away from human interaction. These platforms also harvest data without our agreement and are controlled by separate algorithms created (often by our own students)

[1] A definitive agreement for the acquisition of Scientific Publishing Services, or SPS, from research and education publisher Springer Nature Group. The transaction is expected to close by the end of December 2019, see https://group.springernature.com/us/group/media/press-releases/spi-global-signs-agreement-to-acquire-sps/17457108 and https://www.stm-publishing.com/springer-publishing-company-moves-complete-journal portfolio-to-scholarone/. Emerald - https://authorzilla.com › 01Nw9 › emerald-publishing-group-scholarone.htm

and merged into part of a whole, without proper understanding of the whole. The software itself is integrated into the company/journal by virtue of the decisions taken at board level of the global company that 'owns' the journal. Many academics may be unaware that their preferred journal is actually a part of a stable of journals which in turn is owned by a company whose prime concern may not be academic journals. Football fans might see some resonance here where the owners of their team are more concerned with income the team creates than the game itself. In our case the submission programme might be owned by the parent company which in turn may be affiliated or even support other organisations or activities of which the author may be unaware. Does this mean that authors can be considered as giving their tacit support to such an affiliation and be counted in any statistical analysis? Perish the thought!

The editorial process that was once a link between the publisher and author is now replaced by technology and modern 'editors' do as the software dictates. People are in danger of becoming an extension of a digitized algorithm written by a software engineer about what they think an author should provide before the paper is considered by the academic reviewers

This brings me back to the point of this essay. Systemist is back within the UKSS. It is owned by us and will never fall into commercial hands, aside from that promise it is the UKSS membership that will decide its future. We have developed the journal into a journal which is dedicated to publishing papers from theorists and practitioners across the Systems spectrum. We have a small editorial team and we call upon members of the UKSS to referee papers. The publication process is managed by a managing editor and the Editor in Chief. A hard copy and a soft copy is deposited at the British Library (BL) after each issue. Papers published in both mediums will have been double blind refereed before publication. We exercise the minimum of control over the paper once published. Viz: the copyright can be reclaimed by the author after it has been published on the UKSS web site and the edition is registered with the BL. If the paper is presented/deposited elsewhere the cover page of the edition of Systemist, in which the paper was printed, should be included. Systemist is available at https://systemist.org.uk/articles/ access is, presently, free. Competing with commercially supported journals was never going to be easy, but we hope that as authors begin to realise that we are providing interference free publishing the journal will be a favourite destination. This is particularly the case for the Systems community where, too often, authors of systems papers have to 'bend' the systems part of the paper to fit a journals market. No such restriction exists with Systemist

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Monitoring Poultry Diseases using Computer Vision System: a Survey

Abuka Emmanuel I.[1], E.O. Osaghae[2], Frederick Duniya Basaky[3]

[1]Studies with the Department of Computer Science, Federal University, Lokoja, Nigeria. Email: eabuka@fudutsinma.edu.ng

[2]Associate Professor, Department of Computer Science, Federal University Lokoja, Nigeria. Email: edgar.osaghae@fulokoja.edu.ng

[3]Department of Computer Science, Federal University Lokoja, Nigeria. Email: fdbasaky@gmail.com

Abstract

By definition, computer vision is a field of Artificial Intelligence (AI) that enables trained computers to recognize data in the form of images and video patterns, automating image- based process control. It provides a technology that is robust in nature, such that it can be used to monitor various aspects of agriculture. Automation technology has resulted in significant gains in agricultural productivity in recent years, with computers capable of reasoning, learning, communicating, task scheduling, job execution, and system integration. All of these will remain critical enablers for agricultural intelligent automation systems in the future. Despite the contributions of other researchers towards this connected topic, there are still certain obstacles to overcome. Image/video processing, employing vision systems to detect several diseases in birds, is one of the hurdles, among many others. This survey will look at previous research on the topic as well as other related works, and then present a computer vision-based model for monitoring and controlling diseases in birds using a deep learning approach, with the goal of improving the poultry system's safety and productivity. After the planned survey is completed, Convolutional Neural Network (CNN) architecture will be proposed to create the model. This will minimize disease occurrence when fully deployed as an automatic monitoring system. This model aims to contribute to the latest advancements in computer vision, raising awareness among poultry farmers in the African region and, as a result, maximizing profit.

KEYWORDS

Birds, Computer Vision (CV), Convolutional Neural Network (CNN), Deep Learning (DL), Poultry, Droppings

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Introduction

The world's rising population has served to highlight the nutritional importance of poultry products, within the imperative for humanity to rely on animal agriculture. Poultry farming, which comprises a variety of bird species, is the most widely practiced livestock, and its significance is recognized globally due to the nutrients it provides to the human body. (Neethirajan, 2021). Poultry products, whether consumed as meat or eggs, provide well- balanced, nutrient-dense meals that assist to feed people of all ages in communities all over the world.

Given the health benefits of chicken products, which have resulted in rising demand on a daily basis, the agriculture industry will consider boosting its efforts to improve production efficiency and quality in order to meet market demand. Poultry farmers have benefited from the rising global demand for poultry products (Caldas et al, 2018). Poultry products are a low-cost source of animal protein, which is one of the reasons for the increase (Mueller et al, 2018). The poultry industry is divided into two categories: egg production and meat production.

The increase in consumption of poultry products is due to the improvement in human diets that chicken products have offered (Ren et al, 2020). On an annual basis, the manual practice of poultry husbandry often results in many premature deaths and possible rejection of birds with one or more defects before they are prepared for consumption. Individual or group assessments of animals on a constant basis in small-scale agricultural operations can prevent these losses. On a large-scale farm, however, either group or individual assessment is less practical, regarded as inaccurate and inefficient. This has reignited interest in artificial intelligence (AI) techniques, which need computer vision systems (Neethirajan, 2021).

Recurrent outbreaks of bird diseases have caused significant setbacks in the poultry sector, resulting in financial losses for farmers as well as concerns to human health. Some of these diseases can lead to an increase in human infection, a nd , as a result, chicken illness has become a major concern for poultry farmers. Bird flu, for example, decimated many poultry farms a few years ago, resulting in significant financial losses for farmers. Manual bird observation, particularly in large-scale farming, necessitates a huge number of humans performing checks on a regular basis, but this is labor-intensive and time-consuming. As a result, it is necessary to improve agricultural capability to detect improper behavior in birds in order to preserve good wellbeing without increasing the demand for physical work. This will necessitate the use of an automated system.

When it comes to diagnosing diseases in birds, farmers have always relied on veterinary professionals. Farmers lose some of their birds as a result of late diagnosis, either while waiting for an expert in the field or when an untrained expert is contacted. With the right combination of artificial intelligence (AI) tools, and application of a deep learning approach using computer vision for image analysis, we can easily identify the most common diseases affecting poultry birds from acquired images of both droppings (feces) and captured movements. Research has shown that when the correct algorithm is used, automated vision systems are capable of producing accurate results. As a result, there is a greater need to focus on using artificial intelligence to reduce disease-related fatalities in chicken production.

Survey of Related Works

The term poultry farming is used to describe the rearing of birds (chickens) for domestic or commercial purposes, primarily for meat or egg consumption in agro-agricultural industry. Several breeds of birds are raised expressly for meat production, such as broilers of various kinds, cookery, noilers, and spent layers, while others are raised exclusively for egg production. For greater productivity, the birds used for egg production or meat consumption must be monitored.

Arguably, "healthy poultry system and its product quality rely majorly on good welfare conditions, which tend to improve economic efficiency" (Wathes et al., 2008). Birds in a good state of wellbeing have a healthy physique, a pleasant active state, and the ability to display their natural activities. Using linked cameras and a specific Artificial Intelligence (AI) system, flocks can be correctly analyzed for health purposes, boosting the poultry's survival and product quality. Neethirajan (2021) investigates several specific features of AI for counting, detecting, and tracking birds in commercial and research-based applications, based on recent development.

Cedric Okinda, et al, (2020) provide "A review on computer vision systems in monitoring poultry: A welfare perspective". The review on this topic summarizes steps taken in recent times and the techniques in poultry monitoring using computer vision system with the support of conventional machine learning and deep learning application. Visual observations and sound distinction by certain farmers and veterinarians are the most common methods for diagnosing diseases in birds (Huang et al., 2019; Zhuang et al., (2018); Zhuang & Zhang, (2019). In large- scale production, however, these detection procedures are time-consuming and labor intensive, and in some cases fail to give early detection (Zhuang et al., 2018).

Xiaolin and Tiemin, (2018) in their work, "Detection of sick broilers by digital image processing and deep learning" the authors propose to identify the health status of broilers using deep learning method while using an Improved Feature Fusion Single Shot MultiBox Detector (IFSSD) - an object detection model which is an enhanced 'Single Shot MultiBox Detector (SSD) with effective feature fusion module. IFSSD handles multiple broilers in each separable image. This method could only infer the health state of the broilers based on their physical characteristics; it was unable to identify diseases exhibited. This technology can only detect and deliver an early warning signal when it comes to changes in the health condition of broilers, reminding poultry farm owners to do additional inspections if other unhealthy birds are suspected.

Sadeghi et al. (2015) carried out a study "*An Intelligent Procedure for the Detection and Classification of Chickens Infected by Clostridium perfringens based on Their Vocalization*". A Support Vector Machine (SVM) and Decision Tree were used to identify sick birds, which were also infected with clostridium perfrin-gens. The sound produced by the birds was used to ascertain whether sick or not. Vocals (sound) from the healthy and unhealthy birds were recorded while their facets were extracted and then used to train the classifiers. There was greater increase in its accuracy as the percentage of the neural network gradually increased up to 100%. The study could only be evaluated for one disease, however; other common diseases could not be evaluated all together.

Zhuang et al (2018) likewise used SVM method to determine broilers that were infected with bird flu. The paper "Development of an early warning algorithm to detect sick broilers" proposes an algorithm to classify isolated injected broilers using analyzed (breakdown) structures and extracted attributes. After a thorough examination of the test data, the algorithm was found to be 99 percent accurate.

The observed result indicated that the proposed vision system will certainly be able to detect disease outbreaks in poultry birds early and make further predictions. However, different bird breeds and virus kinds will need to be tested to validate the efficacy of the approach. Despite these flaws, the proposed method produced acceptable outcome and met the research aims of the research.

In spite of good prediction performance from classical machine learning approaches experimented by different researchers, Ferentinos et al (2018) made a presentation that "traditional machine learning techniques are constrained in images and feature processing". In contrast to classic machine learning approaches, deep learning approaches have gotten a lot of interest in the field of computer vision and image classification, especially for improving image categorization and retrieval performance.

Ren, et al. (2020) during their research from 24 universities worldwide, reviewed agricultural robotics as an aspect in Artificial Intelligence (AI). According to varied functions, "agricultural robots can be grouped into three types (monitors, harvesters, and both)." One of the most pressing concerns in robotics applications has been the development of robots for specific agricultural tasks. Poultry production includes keeping track of the birds' ambient conditions, keeping them healthy, and allowing them to wander freely in locations where a deep litter system is practiced. Robotic applications should be designed to include these areas mentioned.

According to Ayim-akonor, et al (2020),he knowledge of Zoonotic Poultry Diseases (ZPD) among 152 poultry farm workers (respondents) from 76 farms in the Ashanti region of Ghana, were assessed about their on-farm attitude and practices that increase their risk of exposure to ZPD. Farmers in the region are exposed to pathogens on the farm as a result of their agricultural practices and attitudes, raising the risk of ZPD infection in the sub-region. The findings of this study are significant and could be used to improve the health of farm workers around the world.

Singh, et al (2020) conducted an in-depth examination of poultry health monitoring using the Internet of Things (IoT) platform and Artificial Intelligence (AI) techniques. I n or de r t o monitor the poultry farm and the health of the birds, the IoT devices employ a variety of sensors for video and image processing, classification, and vocalization (sound) based poultry livestock analysis. The increasing affordability of computational resources, IoT devices, and standard algorithms has created a compelling rationale for using current technology to continually monitor big farms containing millions of birds and enhance overall production. However, in this solution, transmitting data on the cloud for further analysis is a problem.

Using three broiler stunned states: insufficient, appropriate, and excessive stuns, Ye, et al. (2020) developed "an improved fast region-based convolutional neural network (You Only Look Once + Multilayer Residual Module (YOLO) algorithm" to increase the accuracy and efficiency of recognizing the shocked state of broilers. Images from a broiler slaughtering unit were captured using a complementary metal-oxide semiconductor (CMOS) camera. The PASCAL VOC data format was used to designate the area of a broiler's head and wings in the original image, and the dataset of each broiler stunned condition were obtained. The YOLO + MRM algorithm performed best, with an accuracy of 96.77 percent, according to the findings of the study.

Researchers working with other branches of agriculture also contributed to knowledge of the potential of such applications. For example, Athiraja and

Vijayakumar (2021) attempted to "identify the banana diseases in sooner stage". Images were inputted to bring about uniformity using the pre-processing method, and a soft coring filter was applied to reduce noise. The feature extraction process included the extraction of shape, color, and texture features, as well as the application of the classification approach. The case-based reasoning and adaptive neuro-fuzzy inference system were used as algorithms. The decision was made using fuzzy logic. The Receiver Operating Characteristics (ROC) curve was used to test the proposed system. In comparison to a case-based reasoning approach, the adaptive neuro-fuzzy inference system outperformed.

Ojukwu, et al (2020) proposed a computer vision system that could detect inactivity of individual pigs housed in group pens which is potential in alarming the farmer of the animals concerned (known as Deplnact). A total of 656 pairs of related depth data and color photos were captured four times in a row to validate the created system's accuracy and robustness. Using the collected photographs in color background, the verification step entailed manually identifying all of the pigs. DepInact was used to identify all inactive pigs throughout a defined period of time, and the results were compared to those obtained by hand evaluation of color photos of seized pigs. The finding was 85.7 percent accurate, and it offers a feasible alternative to manually detecting inactivity in group-housed pigs.

Below is the summary of related work carried out by researchers and their limitations as shown in table 1.

S/N	Author(s)	Topic/Objective(s)	Methodology	Outcome(s)	Limitation(s)
1.	Neethirajan S. (2021).	"A review to explore the aspects of AI in the detection, counting and tracking of the poultry in commercial and research-based applications"	Machine learning and deep learning approach	Improved farm production through advance Technology	Automated detection and tracking systems are inactive, unable to control or interface with adjustments to ventilation systems.

2.	Okinda, C., Nyalala, I., & Koroho, T. (2020)	"A review on computer vision systems in monitoring of poultry: A welfare perspective"	Research Base: A review of new breakthroughs and innovations in computer vision-based poultry monitoring systems.	Summary of recent improvements in computer vision-based poultry monitoring tools, which includes machine learning and deep learning-based systems.	Lighting issues, occlusion issues, and a lack of enhanced and labeled poultry datasets are factors to consider.
3.	X. Zhuang, M. Bi, J. Guo, S. Wu, and T. Zhang, (2019)	"Detection of sick broilers by digital image processing and deep learning". "To detect broilers while simultaneously identifying their health status and enhance the speed and accuracy of detecting sick broilers using Improved Feature	Improved Feature Fusion Single Shot MultiBox Detector (IFSSD) model	Capable of identifying broilers in a flock in real time. It can also use the appearance of broilers to determine their health state.	The diseases afflicting the broilers could not be precisely identified. The detection techniques are time-consuming, unreliable, and labor-intensive, hence, do not give early detection.
		Fusion Single Shot MultiBox Detector (IFSSD) model structure"			detection. detection.

4.	Xiaolin and Tiemin, (2018)	"Developing an early warning algorithm to detect sick broilers". "Posture-based algorithm for detecting poultry disease"	Support Vector Machine (SVM) Model	The algorithm for digital image processing has proven to have high accuracy, stability, and generalization performance, as well as the potential to provide early warnin g signals .	Could not segment images of birds when there number is increased. This has a negative impact on skeleton extraction and the final recognition performance.
5.	Ren, G., et al (2020)	"Agricultural robotics research applicable to poultry production: a review". "To provide a comprehensive review of published research and development work, emphasizing robotics enabling machine capabilities".	Research Base: Developing intelligent moveable machines for use in poultry houses.	The review shows that there are still numerous problems to be overcome in robotizing agricultural jobs in general and in chicken production in particular.	The job execution and system integration aspects of agricultural robotics have received little attention.
6.	Ayim-akonor, M, et al, (2020).	"Understandin g attitude, practices and knowledge of zoonotic infectious disease risks among poultry farmers in Ghana". "To evaluate farmer's behaviour on farms and identify the	Administration of Questionnaire	The findings of this study can be used to improve the health of farm workers.	The risk of contracting certain diseases from their poultry farms is not well understood.

		risk factors to develop tailored control strategies"			
7.	Singh, M, et al (2020)	"Artificial Intelligence and IoT based Monitoring of Poultry Health: A Review" "A comprehensive review of poultry health monitoring using Internet of Things (IoT) platform employing Artificial Intelligence (AI) techniques"	Generative Adversarial Networks (GANs) with the provision of generative modeling technique using deep learning. Decision Tree, Random Forest, Naive Bayes, and Support Vector Machine are applied as the Algorithm used	The development of a precision livestock farming system with the ability to track, monitor, detect, and predict disease in poultry chicken at an early stage using an IoT based predictive service architecture.	The precision of identifying thousands of poultry birds in commercial farms makes image analysis difficult. It's also difficult to transmit the chicken's movement data to the cloud for further research. difficult to track, monitor, detect, and predict disease in poultry chicken at an early stage using an IoT-based predictive service architecture It's also difficult to transmit the chicken's movement data to the cloud for further research.

8.	Ye et al. (2020),	"Broiler stunned state detection based on an improved fast region- based convolutional neural network algorithm"	Improved fast region-based convolutional neural network (RCNN) algorithm	Faster-RCNN+MRM have a greater degree of accuracy and can identify the stunned state of broilers more promptly.	The issue of under-stunned and over-stunned broilers, as well as the resulting carcass damage caused by inappropriate stunning.
9.	Athiraja, A., & Vijayakumar, P. (2021).	"Banana disease diagnosis using computer vision and machine learning methods"	Case-Based Reasoning and Adaptive Neuro- Fuzzy Inference System	According to the findings, the Adaptive Neuro-Fuzzy Inference System outperforms the case-based reasoning system.	Other banana diseases could not be captured.
10.	Ojukwu, et al (2020)	"Development of a computer vision system to detect inactivity ingroup-housed pigs". "To detect inactivity of individual pigs housed in group pens which is potential in alarming the farmer of the animals concerned"	The algorithm was developed and implemented in Matlab. DepInact was used for detection	With the threshold and loop count set to 75 pixels and 15, the system was able to obtain a detection accuracy of 85.7 percent.	Pigs lying in close proximity to one another are difficult to segment hence, the challenge of detecting the inactive ones

Table 1: Summary of related work by other researchers and their limitations

According to the results of the survey, automated computer vision systems based on the Convolutional Neural Network (CNN) algorithm have not been fully adopted for use in the poultry industry, necessitating the need for this survey to recommend a model based on the CNN algorithm to achieve our goal. CNN has been proven to be

the best in image processing in research surveys, producing excellent results and accuracy.

Computer Vision in Poultry Farming

There is need to deploy the use of Artificial Intelligence (AI) Technology to poultry farming, especially in the African region where the practice is usually 99% manual. As a result of this practice, farmers often lose birds in large capacity. These birds most times develop diseases within the night watch where there is little or no supervision. Okinda et al (2020), suggest that "Regular monitoring to minimize human labor and maintain affordability is critical to the profitability and productivity of commercial chicken production".

In livestock monitoring, human surveillance is no longer a viable option. As a result, the Precision Livestock Farming System (PLF) has proven to be a useful alternative to the problems mentioned by Okinda. These difficulties can be overcome by implementing efficient automated systems while ensuring acceptable animal welfare. "The Precision Livestock Farming System (PLF) is a stockmen's support system for monitoring various bio-processes and bio-responses linked to animal welfare, health, and productivity" (Banhazi et al., 2012; Berckmans, 2017; Wathes et al., 2008).

Because of the advance of technology and the numerous benefits that computer vision systems have brought to animal monitoring, PLF with a vision-based system has become a very important study area. A computer vision system has the potential of providing non-intrusive and non-invasive, constant (without distortion), effective, and objective supervision. There is provision for data recording for the purpose of using the data in the future and data analysis as well. In addition, computer vision helps human to reduce tedious and strenuous work which are labor-intensive. It has a powerful sensing system that may be used to monitor many areas of the farm. "Automated tracking platforms can accurately manage the detection and prediction of abnormal behaviour and poultry diseases" (Fang et al., 2020).

The use of these systems in the poultry farming system allows for data collection and analysis (see Fig.1).

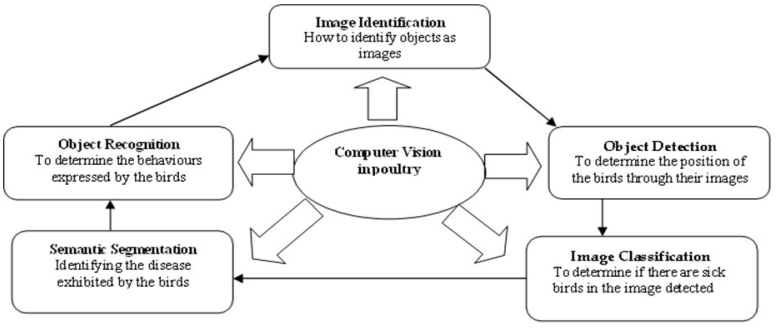

Fig 1.0 Description of poultry farming system with the aid of computer vision

Computer Vision System and its essential Components

The employment of mathematical principles, computer science, and systems integration to enable image-based automated process control is known as computer vision. The two categories of computer vision-based systems are machine learning and deep learning-based systems. Computer vision system's main components are the camera sensor, image processing board, software, and hardware. The camera sensor converts photons into electrical impulses.

Thermal and infrared (IR) depth-based sensors, as well as visual light-based charge-coupled devices (CCD) and complementary metal-oxide-semiconductor (CMOS) sensors, are used to capture images of birds in their surroundings in poultry monitoring systems. The digitizer, also known as the image processing board, turns the visual image into numerical form known as pixel.

Proposed Model

Three major components as methods to develop the proposed model shall be considered. These components form the proposed framework for detecting diseased birds as seen in figure 2.1. They are:

1. The Image Capturing Component.
2. The Image Processing Component

3. The Output Component

In the first component (Image Capturing Component) of the computer vision system, sensor cameras with lightning devices will be connected to acquire images. Cameras are critical components of computer vision systems, aided by sensors that allow the capture of objects in the form of images. The sensor cameras will be placed to capture moving birds and their droppings (feces) in order to examine their health, while acquisition software will be used to properly analyze the captured images. For example, the "eYeNamic" (Fancom BV) which is capable to automatically monitor the behavior (in a non-intrusive pattern) of birds, "Analog Discovery" used for image analysis and "HOBO H8 Data Logger" which measures and transmits signal data wirelessly to mobile devices using Bluetooth technology will be considered as useful acquisition software used in this proposed model. The birds' droppings will only be used to create a dataset to evaluate if they are healthy or unhealthy. Because there are so many diseases that affect birds, this proposed model would only address one of the common diseases, while future research will include several diseases.

From survey, it is observed that researchers are beginning to pay more attention on the use of OpenCV, Tensor Flow and Keras as data analysis software. Tensor Flow, an open-source software will be used in the development of Deep Learning model in this proposed work with Keras an Application Interface (API) embedded on Tensor Flow.

The second component, (Image Processing Component), allows image pre-processing such as image cropping and augmentation to be carried out to enable the data to be expanded and to improve the learning process. Image processing consists of the following: image pre- processing, image segmentation and feature extraction (visual data conversion) and poultry tracking modelling.

The third component (Output Component) is for testing and training through feature representation as learned by the hidden layers of each deep learning model using Convolutional Neural Network (CNN) Architecture. Each learning model's ability to recognize the droppings will be assessed through a testing method before we can have the desired model.

In summary, the first input device, a camera sensing device, would be trained to identify moving birds as well as their droppings, according to the proposed architecture. Attention shall be given more to their droppings as earlier mentioned because healthy or unhealthy birds are often determined through their droppings. Images of their droppings will be captured, stored, and selected using the data acquisition software's mentioned in the output component to be further pre-processed in the second various segments using image segmentation. The image features will be further extracted from the segmented images.

Finally, the classification task will be carried out using the appropriate modelling method, which we propose Convolutional Neural Network (CNN) for the research

purpose. The proposed model can be achieved through Google colab using python, with embedded Tensor flow packages, (keras library inclusive) and running the training set on a good performing computer system running Microsoft windows 10. There is software that can be used to obtain desired result at each of these components as seen in fig 2.2 Thus, the modelling should be able to determine healthy and unhealthy birds. All of these processes are further shown in fig 2.0, fig 2.1 and fig 2.2 respectively.

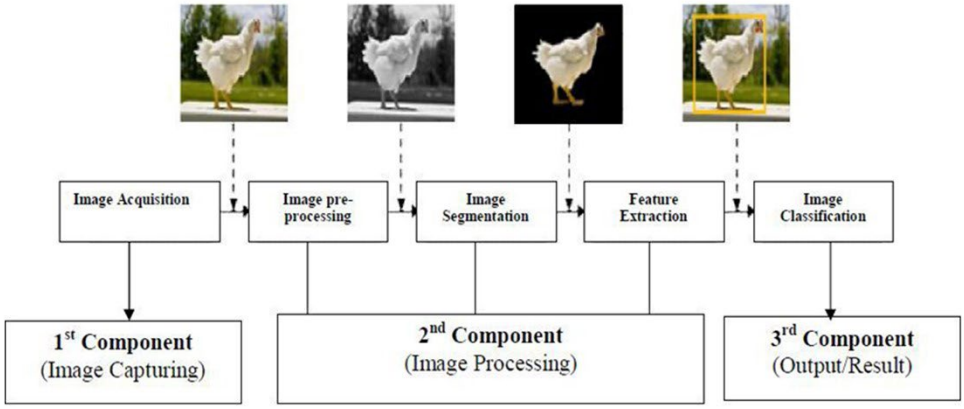

Fig 2.0 Image process scheduling in poultry farm

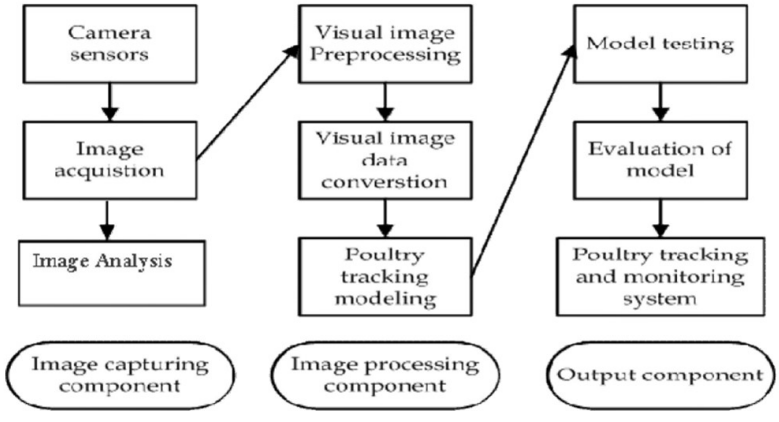

Fig 2.1 Proposed Frameworks for Poultry Monitoring System

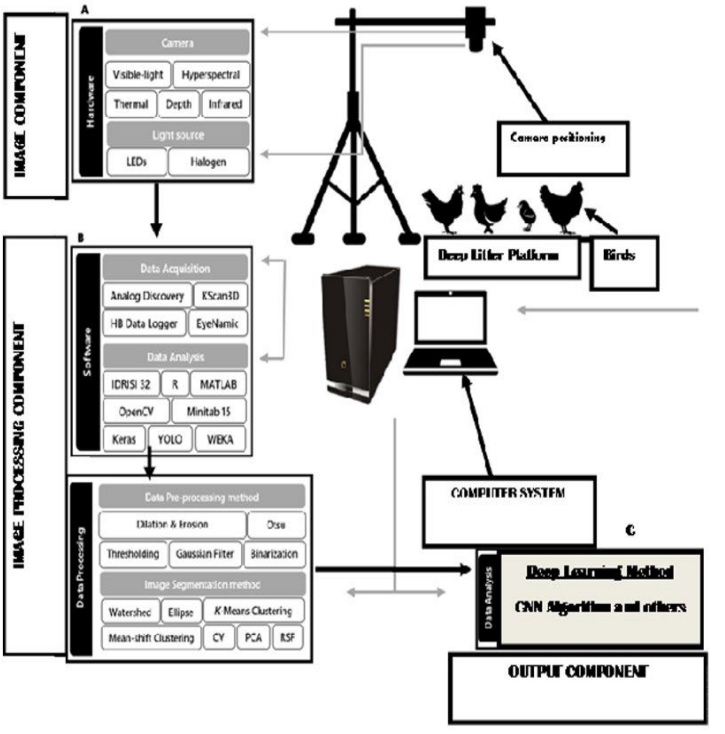

Fig 2.2 Proposed Model Structure using Deep Litter System

Conclusion

Monitoring birds' behavior allows farmers to identify pathological changes early and discover factors threatening the health of birds in advance. Poultry farming are widespread venture both on small and large scales. Research has proven that manual observation of these birds is time consuming and labor intensive.

Again, computers technologies (such as computer vision) can be deployed in monitoring the growth processes of birds in real time. Identifying the length and frequency of postural shifts in birds over time can aid in the prevention of sickness outbreaks that could put their health at risk. However, the survey has shown the extent of work carried out in the area of this research topic hence the need for the recommended proposed model using computer vision system in an automated fashion and to adopt deep learning approach using CNN algorithm. Therefore, the proposed model will be recommended for implementation to determine the effectiveness of the model in real-world scenario for future works which will greatly be of immense help to poultry farmers in managing their farms effectively.

It is important to detect diseases in birds timely and allow veterinarians take necessary actions

as expert in the field thereby preventing loses and as well maintain good animal welfare status. Thus, this survey with the proposed model can be applied as a vision monitoring system for the whole life span of birds reducing the need for frequent visits from veterinarians.

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The development of a new framework for assessing major events informed by systems thinking

Debbie Sadd and Gary Evans
The Bournemouth University Business School, Talbot Campus, Fern Barrow, Poole, Dorset, BH12 5BB
Email: gevans@bournemouth.ac.uk and dsadd@bournemouth.ac.uk
Webpage: http://www.bournemouth.ac.uk

Abstract

This paper sets out how Viable Systems Methodology (Beer, 1979) was used for modelling purposes to inform the design and development of the Framework for the Assessment of Major Events (FAME). We assert FAME has a strategic advantage over other events frameworks, such as In England and Tourism Southeast, because these frameworks lack the requisite variety to reconcile the complexity of events planning and management and fail to recognise recursion in organisational decision-making. We also had concerns with how the frameworks engage communities, partners, and stakeholders. We present data from three destination case studies to show the effectiveness of FAME and make the case FAME can uplift the strategic planning and management for events to add value to destinations. In doing so, how Systems Thinking and Systems Practice (Checkland, 1981) can significantly enhance organisational methodology. Further, the use of models for visual impact and give context and structure to the decision-making processes of organisations, as argued by Bryson et al. (2004).

Keywords: assessment, case studies, destinations, events management, Framework, models, stakeholders, systems thinking, and viable systems methodology.

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Introduction

This paper was prepared before the onset of Covid-19 and thus is written on the assumption that events will restart sometime in the future from 2021. The Government have announced their 'Festival 2022' (https://www.gov.uk/government/news/2022-festival-update) and other encouraging signs of an events rebuild, thus this paper and the resultant findings will help in the rebuilding of destinations event portfolios. The study relates to the need for a sustainable portfolio of events in towns and cities beyond purely economic considerations, yet also being planned and organised during times of budget constraints for local and regional authorities.

The appeal of Viable Systems Methodology (VSM) (Beer, 1972) is because we recognise its cybernetic theory of Organisation may help events organisations to uplift their adaptability and Organisation, to survive the demands of an ever-changing business environment. VSM promotes the logic that event organisations are viable system based on five higher and lower ordered systems and are recursive and systems nestled within systems, as illustrated in Fig 1. Such an approach should enhance the understanding of event planners and their decision-making processes underpinning this study's purpose. Their decisions form the basis for the agreement to run a portfolio of events and the bureaucracy/decision-making involved at every level. Furthermore, it looks at past criteria used to evaluate post, during and after event impacts, especially around evaluations of the event viability.

The study looks at three very different case studies of destinations and cities, with diverse events and stakeholders. Yet, commonalities have emerged as to the very ad-hoc and non-systematic evaluation methods that have been used in the past, resulting in unsustainable events and events agreed for the wrong reasons. None of the destinations used a robust softer systems approach to decision-making, yet they are now using an evaluative tool to reduce the levels of bureaucracy and to help make decisions more robustly and timely, while ensuring the events meet stakeholder needs.

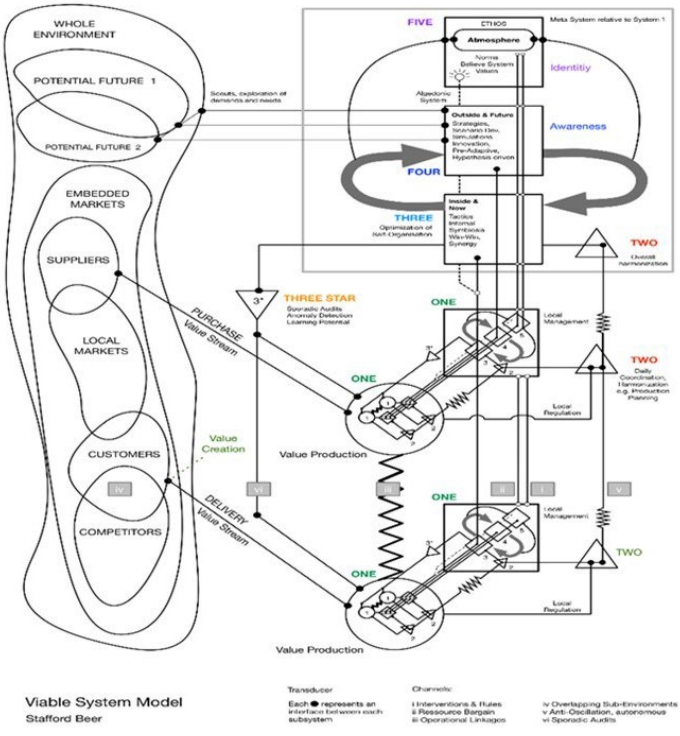

Fig 1, The Viable System model (Beer, 1972)

In the past, assessment of events tended to use the England Tourism Southeast (ETSE) framework. They assert their framework is appropriate because it focuses on minimising negative in favour of positive impacts, as Sustrip (2012) argued. However, from our perspective, it appears to be a 'one size fits all' design that does not consider the local level requirements or nuances. Their framework seems simplistic and lacks the requisite variety (Ashby, 1957) to reconcile local events partners' wants and needs. Ashby asserted that planners need an approach capable of dealing with the inherent complexities of a given situation for planners to make sense of their environments. Delivering events has multiple challenges and considerations, which we see as connected in some way that the ETSE framework fails to capture. Moreover, addressing negatives rather than minimising them will lead to learning for better events impact. Thus, we contest that the ETSE framework is incomplete in effectively planning and evaluating events that are complex activities. We make similar observations with the other popular events decision-making model, the ABCD model proposed by McKinsey (McKinsey.com).

Why this study focuses on Systems Thinking (Checkland, 1981), it is crucial to define what Systems Thinking means. Checkland seems to define such thinking as "an attempt, within the broad sweep of science, to retain much of that tradition but to supplement it by tackling the problem of irreducible complexity via a form of thinking based on wholes and their properties which complements scientific reductionism" (p.74). More recently, McKey (2019, p.126) adds to this by asserting for a system to exist, "there must be interconnections and a purpose and function". In the context of this study, while mindful of the positions of Checkland and McKey, we perceive Systems Thinking (Checkland, 1981) as a holistic approach to events management and its system boundary, as called for by Midgley (2000, pp.137-146), as follows:

A system to plan, deliver and evaluate) cultural events involving multiple stakeholders in the conurbation of interest for positive economic and sustainable impacts.

We assert Systems Thinking (Checkland, 1981) is necessary because there is little evidence to suggest such an approach exists in the field of events management; thus, limited cognisance by planners of the complex synthesis of events interconnections, subsequent behaviours, and outcomes. We argue that their lack of appreciation of events feedback loops to uplift decision-making in interconnected environments results in ineffective event planning, delivery, and evaluation. We interpret their behaviour as a single or classic negative feedback loop that Sterman (2000, p.14-19) warns is deficient for organisational learning. It is far better for planners to acknowledge the causal structure of relationships, the implications of behaviour if stakeholders operate in isolation, and how they reduce events' economic and sustainable impacts. If planners adopt a System Thinking (op cit) approach, it enables the causal relationships to be better understood and interpret events' emergent properties more quickly. In other words, what Sterman calls double loop feedback for deeper learning is necessary for systemic change.

Here, we are attempting to prove cultural events decision-making traditionally involves many tiers that can be potentially enhanced for efficiency and effectiveness if adopting a System Thinking (Checkland, 1981) approach. Our focus is on the relationships between all the relevant stakeholders and their needs and involvement in the decisions at each level of the hierarchy of the proposed cultural events Viable System (Beer, 1972) model. It is opposite to the domination of events organisation being predominantly by planners. Planners must be alert to the levels of recursion and interconnection of functions. Through three case studies, we will evidence how a Systems

Thinking (op cit) approach benefitted each destination using our VSM-inspired Framework for the Assessment of Major Events (FAME).

Historically cultural events

For many destinations, especially those with a tourism portfolio, they have recognised the need for regeneration strategies to re-invent the destinations or the consequence could result in suffering a decline in visitors and diminished local spend. This is increasingly apparent in a global world where travel was internationally focused (Agarwal, et al 2018). A strategic approach is often needed to draw visitors to any future tourism portfolio and to establish which marketing programmes to undertake. Therefore, a good, well-planned events portfolio is vital for the marketing approach used. Andersson et al (2020), advocate those events are important when maturity levels have been reached when resorts are in permanent state of development, when innovative ideas to support resort growth become more important than ever to thwart off decline. Any initiative should be formulated to keep the resort/destination popular with returning visitors but also to encourage new market groups. These events do not have to be focused on sport and education but also to focus on history and culture. Smith (2005) argues for the inclusion of 'resort reimaging' and the role events can play, although he does focus on larger scale events including hallmark and major events, but his arguments hold true for smaller events too. To support resort/destination long-term sustainability, Benedict and Houghton (2009) suggest that the diversification of the economic base is a suitable strategy, thus supporting the argument that a suitable portfolio must consider the triple bottom line approach. Therefore, environmental, and social impacts must also be part of the decision-making process, beyond just the economic goals.

Infrastructure legacies and community impacts

Organisations that represent destinations and resorts need to learn and adapt through strategic planning which events best meet the strategic aims of their destination/resort (Getz, 2008), and that those organisations prepared to adopt this approach are more likely to survive. This is especially true for those who forward plan with respect to their infrastructure and event viability through using robust decision-making systems. Sadd et al (2017) argue that the less an event is tied into purely profit making commercially and therefore short-term, the less likely it will succumb to old age or competition as argued by O'Reilly (1986), Lindberg et al. (1997) and Getz (2008). (This is important in the

building of new infrastructure, although not a focus of this study). Destinations naturally go through lifecycles (Agarwal, 2018); however, from the residents and local communities' point of view, it is the overall portfolio that is of a greater importance for the sustainability of a location (Getz, 2008; Getz and Andersson, 2009).

Agarwal (2002; 2018) argues that a greater sense of place distinctiveness is needed within resort/destination in that natural facilities in contrast to man-made infrastructure can have a significant role to play in overcoming resort decline. More contemporary applications of these theories can be seen from Dickinson et al. (2016), Garcia-Ayllon (2016) and Heuwinkel et al. (2018), all of whom still show the importance of considering this theoretical approach to viability and sustainability. Furthermore, the importance of community involvement in decision-making and future planning, encourages the community buy-in Haywood (1988) previously argued by saying that responsible and responsive planning in tourism development, including the community through citizen involvement, advocates better support than centralised government decision-making, yet it is not a common place initiative.

A system developed that incorporates the views, wishes and requirements of key stakeholders within a destination/resort location, agreed through a series of seminars, involving representatives of all these key stakeholder groups, can support the decisions around a viable and sustainable event portfolio moving into the future. The development of FAME is one such approach.

The theory

Because of our cultural events management experiences and applied research, we recognised a hierarchy of decisions involved in planning, delivering, and evaluating events. Yet, planners seemed to give scant regard to the decision levels at the expense of cultural events' economic and sustainable impacts. Their thinking is more reductionist, compounded by events evaluation frameworks, such as the ETSE, that lack the requisite variety (Ashby, 1957) to reconcile the events management complexities. We also observed that the events assessment evaluations restrict boundary judgements to a few planners resulting in the marginalisation of others that Midgley (2000, pp.142-146) warns about, who could offer invaluable insights on how to improve the events management processes. From our events systems analysis, we identified policy, external environment, organisational, coordination and delivery decision levels they inadequately cover in the events evaluation frameworks. Thus, we were determined to address this deficiency by promoting a Systems Thinking

(Checkland, 1981) approach to consider all the events levels by engaging a range of stakeholders who could offer a view to uplift events planning, delivery, and assessment. Our perceived benefits of a Systems Thinking (op cit) approach are it offers an iterative learning process when searching for new solutions, creates a shared dialogue amongst stakeholders, and promotes holistic or *total systems* thinking (Beer, 1984).

The decision levels we identified, and the version of Systems Thinking (Checkland, 1981) we are proposing is Viable System Methodology (VSM) (Beer, 1972). Beer argues for an organisation to survive and thrive in its environment, it needs to be adaptable to safeguard its future state. To realise viability, Beer specifies five higher and lower ordered systems, with his Systems 1 to 3 focusing on an organisation's operations, and Systems 4 and 5 on the external environment and policy decisions, as illustrated in Fig 1. Beer refers to Systems 1 to 3 as *here and now* and System 4 as *there and then*. System 5 as balancing the needs of Systems 1 to 4.

His System 1 is the operational delivery of an organisation's products, services, or other vital transformational processes. It is the 1st level of recursion and is readily detectable in organisations. System 2 is the control, coordination, and communications crucial to S1's performance and prevents it from oscillating. It is the 2nd recursion level and is sometimes difficult to detect in organisations. System 3 is the broader Organisation that implements the structures, rules, resources, rights, and responsibilities for S1 and S2. It is also the conduit to Systems 4 and 5 and the 3rd level of recursion and is more apparent to detect when applying VSM. System 4 is the environmental scanning function that attempts to identify future demands for the Organisation and satisfies the data requirements of S1, 2 and 3. It is the 4th recursion level and, again, difficult to detect in organisations. System 5 is the policy and strategy function of the Organisation tasked with maintaining the Organisation's overall variability and steerage of the *total system*. It is the 5th and final level of recursion and often an organisation's board, leadership, and governance.

Beer (1972) asserted that for an organisation to be a viable system, it must have Systems 1 to 5 to have the architecture to respond to the dynamics of the external business environment. He used a human biology metaphor to express his viable system, viewing Systems 1 to 3 as the ancient brain or autonomic nervous system and System 4 as cognition. System 5 the higher brain thinking functions. Beer further stressed that a system could be part of a metasystem, and each system in the viable system model could be a possible system.

Here, we used VSM to determine how to match the evaluation criteria to Systems 1 to 5. System 1, the resources utilisation criteria, and System 2, to evaluate the flow of resources to System 1 and its services to events customers. From System 3, the evaluation of the delivery processes of System 1 and the ongoing monitoring, control and causes of resource deviations. Also, from the auditing function of System 3, the criteria call for recommendations from System 4 to address any resource deficiencies. Finally, from System 5, the criteria for determining which resources and how to prioritise those resources. Table 1 shows how we used the criteria to determine how they relate to VSM to inform our design of FAME. Fig 2 illustrates FAME as an evaluative process for events.

Beer (1972) further established five rules for applying VSM users should note, as summarised here. Firstly, the *regulatory aphorism* that a user needs not to enter the black box to understand the nature of its performance or calculate its variety. Secondly, the *principles of Organisation* need to equate and designed in such a way that happens, and the management, operation and directional channels should have higher communications transmitting capacity. The variety of the transducer at the system boundary must also be equal to the variety of the communications channels. Thirdly, the *recursive theorem* that a viable system contains and is part of a viable system. Fourthly, *axioms* that horizontal variety should equal the system's vertical variety. Lastly, the *law of cohesion for multiple recursions* that the variety of System 1 is accessible to Systems 3 and is equal to the variety of the total system for each system's recursion.

The viable systems 1 to 5	*VSM influence on the design of FAME*
S1, concerned with implementation	Tweak and amend any anomalies that emerge through repeated testing, and soft launch framework on new event proposals
S2, coordination of S1	Revisit weightings and test through the framework with existing events
S3, control function and internal stability	Test weightings with stakeholders, place weightings on the criteria in relation to precedence in meeting objectives, and determine the criteria to therefore be evaluated
S4, intelligence gathering and reporting	Determine key drivers within destination of an events portfolio
S5, policy and strategy	Determine key destination stakeholders and determine the key objectives to be met.

Table 1, How VSM influenced the design of the FAME evaluation criteria Source: authors

In addition to the appeal of Beer's (1972) viable systems model and its five higher and lower ordered systems that influenced FAME's approach to evaluation is his method for measuring System 1's performance. Here, Beer (1972, pp.163-165) views performance as a calculation of the actuality, capability, and potentiality of System 1.

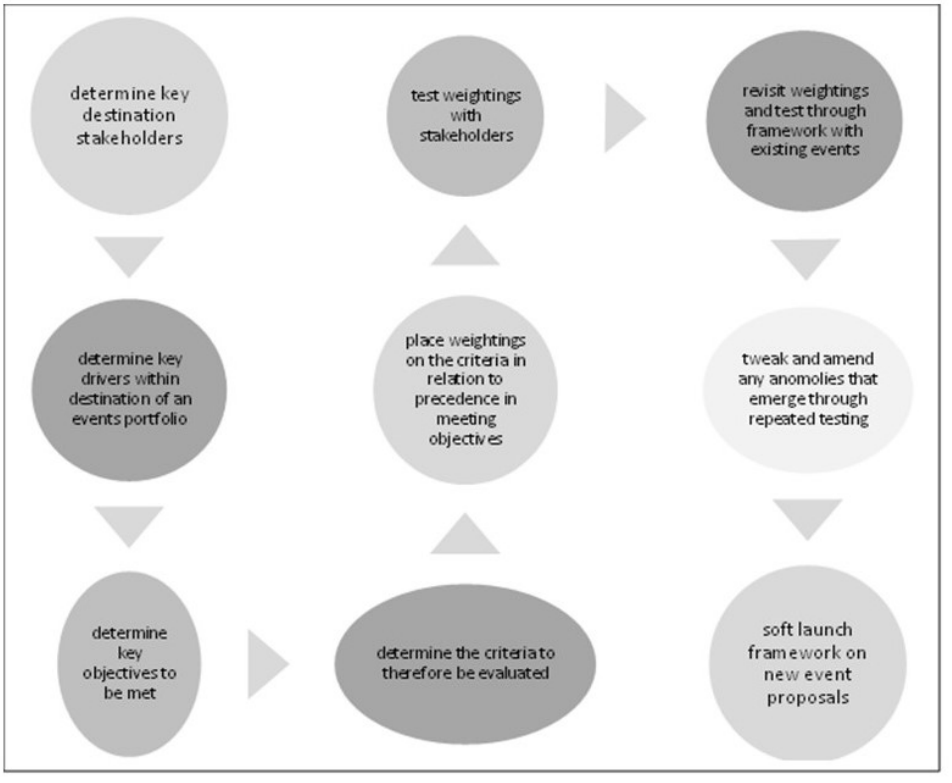

Figure 2

He defines these as "actuality, what we are managing to do now with existing resources and constraints… capability as what we could be doing with existing resources and constraints… and potentiality, what we ought to be doing by developing our resources and removing constraints" (p.163).

Beer (1972) stresses that it is System 4's responsibility to realise System 1's performance improvements. He indicates that potentiality, capability, and actuality can be measured in terms of latency and productivity, resulting in

improved performance. The ratio of actuality and capability is his measure of productivity—the ratio of capability and potentiality for latency, and latency and productivity as the measure of performance. We perceive learning as derived from attempting the calculations on the first instance and then understanding the nature of deviations because something went less well, especially under actuality and capability measures. It is the focus on potentiality where we feel FAME can help improve the performance of events organisations. However, it continues as an area of inquiry for us as each event thus far has different costs and income drivers. Fig 2 illustrates the triple vector of System 1 performance, with planning switching from normative to strategic (SMART objectives) to programming (tactical decision-making) as calculations progress from left to right when viewing the model.

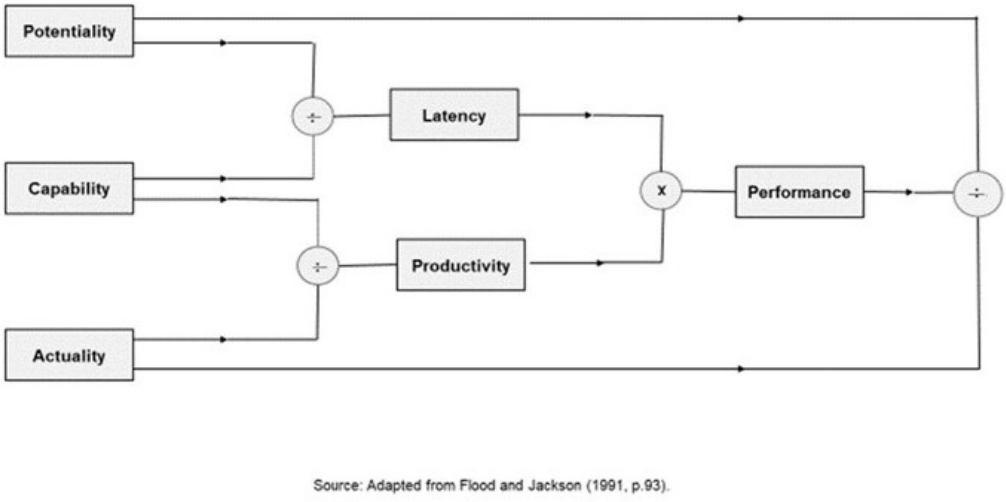

Figure 3 The Triple Vector of System 1 performance

Tepe and Haslett (2002) argue that because of the enormous amount of paperwork often associated with decision-making, including compliance regulations, policies and procedures, the process sometimes fails to give the governance and validity needed. However, with a viable system (Beer, 1972) approach, the physical paperwork and policy compliance users can simplify if they design their system accordingly. They need to organise their systems to be effective and allow for corporate governance based on the work of Beer (1972), as Tepe et al. recognised the valuable insights that VSD gave to information needs and communication flows through complex organisations. It is like the

issues discussed in this paper - by engaging the client and stakeholders in discussing the problems and formulating the solutions, it appears systemic changes have a better chance of being implemented. The larger the decision-making tree, the more difficult it becomes to show accountability and responsibility, hence, the need to engage people.

Further, Tepe and Haslett's study emphasises the importance of stakeholder engagement in designing the governance system to ensure effective organisational structures and information flows. Macdonald, Burke, and Stewart (2006) asserted the need for effective governance and leadership systems, especially for people and their involvement in organisational decision-making processes. In the Tepe et al. article, the Russian doll analogy of systems within systems resonates with the decision-making levels; thus, all have systems that need some central organisation within the system hierarchy. We assert organisation around the principles of the viable system (Beer, 1972) model, especially in second-order cybernetics mode (Espejo and Harnden, 1989). Espejo et al. differentiate first-order and second-order cybernetics with first-order as the world and a system within and second-order when the focus switches to the observers as the system. Espejo et al. also argue for a paradigm shift from objectivity to subjectivity to understand the viewpoints of the system actors to arrive at a better truth of their reality. We propose the second-order paradigm shift to engage planners and stakeholders within the FAME process to evaluate their governance and event systems for improvement.

Advocating the second-order cybernetics (Espejo et al. 1989) method accords with action research favoured by Checkland (1998) to systemic inquiry to capture knowledge and prior experience of system actors in an action-oriented decision-making cycle. As an alternative to hypothesis-testing research of the hard sciences, Checkland (1998, p.22) explains soft action research as:

> *An alternative view is that social reality – what counts as 'facts' about the social world – is continually being constructed and re-constructed in dialogue and discourse among human beings and in their actions. Researching social reality then becomes an organised discovery of how human agents make sense of their perceived worlds and how those perceptions change over time and differ from one person or group to another*.

Thus, the resultant actions are formulated from using prior knowledge and experience and the actions taken can then be reviewed considering the decisions made. Also, consulting stakeholders to play a role in the construction of the decision-making process leads to the formulation of solutions and allows these

same stakeholders to take a degree of ownership in the outcomes. This becomes an iterative process of using these decisions to inform the next round of decision-making and the resultant outcomes best described as learning for action (Checkland and Poulter, 2006). Any formulated framework, designed with corporate governance at its core, becomes a source of information flow that allows an organisation to learn, adapt and remain viable (Sadd et al 2017). This internal information flow includes, policy requirements, accountability, audit data and performance feedback, (Tepe and Haskett,2002; Sadd et al, 2017).

Furthermore, by making the designed FAME flexible, it can support and respond to rapidly changing complex environments. By ensuring all units and structures involved in the information gathering as part of the decision-making are involved and have access to the information, data and intelligence needed, this will allow them to deal with and manage issues and problems through the roles they undertake. It is important to recognise that this does allow for the adaptability mentioned already in response to rapidly changing organisational situations, as argued by Scott et al. (2007).

Kawalek and Wastell (1999) argue that whilst the original intention of VSM (Beer, 1979) was in the study of cybernetics within management science, their focus on sales teams and database management highlighted how VSM (ibid) helped to challenge assumptions and allowed the company to question on how to capture the diagnostic capabilities for future developments. More recently, Burgess and Wake (2012) suggested that whilst a lot of attention in relation to VSM (Beer, 1979) is via larger organisations and corporate entities, it can also benefit SME's as shown in their study and this applicable to any organisation, including public and local government as shown in this paper. Further, we found the tourism and manufacturing VSM case studies offered by Jackson (2000, pp.166-169) and Flood and Jackson (1991, pp.96-109) to be extremely helpful.

Thus, this research analyses the development needs of three destinations and how the develop of bespoke systems thinking frameworks has enhanced their processes around decision-making and portfolio design. All three destinations are at different stages of the lifecycle of development.

The event management case studies

Here, three case studies are being used to highlight the importance of systems thinking for Local Government and NGO's. All three examples are at varying

stages in the development of systems adoption but worthy of inclusion to highlight the important contribution that Systems Thinking (Jackson, 2003) can add to their decision-making processes. This is needed more than ever, as the decision-making process in all three examples involve internal and external stakeholders, with several levels of bureaucracy.

Case study 1

One is a local government/council with a year-round event portfolio comprising of a diverse range of events from local community to major international hallmark events. Historically, they had arranged events predominantly to enhance their tourism offer. Decision-making was ad-hoc based around a limited budget supplemented by sponsorship from a diverse range of sponsors. Events were not considered on a range of criteria to meet stakeholder needs but to meet tourism needs. However, it was decided that due to the development of one major event, the level of expertise gained in-house warranted the exploration of other major events. However, the decision-making process was engulfed with so many internal and external stakeholders all becoming involved in many different decision-making levels and struggling to reach consensus of decision-making. Consequently, events were designed for and with the support of a limited number of stakeholders and the resultant opposition often meant lack of engagement with some of the event ideas. The process was in danger of over-whelming the original objective of exploring the possibility of other larger events, whilst also satisfying the complex requirements of the area's major stakeholders. Multiple layers of bureaucracy were preventing lean and agile decision-making, so a working group was formed from industry, local government, and academia. Its purpose was to develop a smart system, using System Thinking (Jackson, 2003) to collate and make decisions based on pre-defined important information gleaned from a collective list of stakeholder requirements. This was trialled and launched to great success and one of the most successful events in the area was only sanctioned after the system developed gave a detailed report to the ultimate decision makers. This event has subsequently won national awards for best new event concept.

Case study 2

Two is an NGO tasked with developing an events portfolio in an historic city that again has a diverse set of stakeholders. In addition, they have a range of historic events they are tasked to organise but with a very limited tourist portfolio. Traditionally the residents in the surrounding area do not visit the city to support the normal events organised as they do not see them meeting their needs. A thorough event portfolio overhaul was needed. Their primary remit is

to develop events to encourage the local community who live around the city but rarely venture into the centre to spend money. This Organisation has just adopted a bespoke system, based around the same stages of development mentioned above, in bringing together the key stakeholders to develop an agreed viable system, which was launched for usage just as C-19 Pandemic struck, so has been put on hold. However, it is now being used to assist decision-making to become leaner as events begin to emerge. This NGO, whilst controlling a budget on behalf of local stakeholders, is controlled by a county organisation, which has conflicting demands on its resources, so additional levels of decision making. However, the adoption of the viable system has their support and ratification.

Case study 3

Three is an NGO not based in an historical tourism destination, rather a travel and transport hub and therefore, traditionally not recognised as an events destination. However, the need to develop an events portfolio for the local community for social and political reasons has emerged from several key stakeholder groups. Thus, as an NGO, they are tasked with bringing together the various stakeholders and funders to develop a new events portfolio. The Local Government do not have a tourism/events division and therefore, the events portfolio receives not funding from Local Government. It was an imperative, then, that they are choosing the right event portfolio to meet the major stakeholders' objectives, especially in the coming years. They were to participate in the viable systems workshops to design their system, but this was placed on hold by C-19. However, they have been included here as an example of the complexity of the historic decision-making process challenging the NGO.

Each Organisation contacted us, the research team, through networking events and pre-existing relationships based around the knowledge of the capabilities of the University in designing and working with systems thinking to develop a smart thinking approach to decision-making. In 2012, a Higher Education Innovation Fund bid supported the project to develop, alongside the Local Council and key stakeholders (internal and external), a framework to support their events decision making, with the project concluding late 2018.

Research methodology

The methodology adopted here was structured around a similar approach to each Organisation, albeit over different timeframes. A systematic review of a range of paperwork from the three case studies, combined with the interviews

and questionnaires distributed to the various decision makers in each of the three destinations, formed the research undertaken. Also, the methodological approach is deemed the most relevant as to investigate the processes and systems currently in use by these organisations, it involves a close examination of secondary materials already available. Further, the collection of primary data by hosting focus groups and meetings in the three event destinations. These focus groups contained representatives from the relevant stakeholders for the destination in question and the representatives of the key decision-makers and gatekeepers. They varied slightly from destination to destination, but the importance was that they were the main gatekeepers for the decisions being made and the spokespeople for the viable system (Beer, 1972) analysis.

The structure for the methodology follows the Viable System Model (VSM) (Beer, 1979) set up and investigates from the material and data collected the constituent parts of the model. The VSM (ibid) analysis also allows for the development of a database to be developed via the FAME framework of decision-making and combined with VSM (ibid). The first phase, the systematic reviews, were followed-up with scoping interviews and then meeting with stakeholders to discuss existing decision-making channels. The second phase was to revisit each destination and then hold focus group with representatives of all major stakeholder groups to discover the key drivers and requirements from an events portfolio perspective. This was the most challenging part as often it was impossible to try and align all the diverse requirements; however, *satisficing* was used to try and meet most of each stakeholder's requirement.

The opportunity to work with the three destinations was an iterative process as the first destination was an existing partner in a government funded project. The original funded project was part of a £9m injection into developing some strategic decision-making around resort development. The relevant part of the project for this work concerned the development of what was termed a *learning destination*. This involved the formation of a group of key stakeholders and gatekeepers in terms of the needs of the destination in capturing knowledge and decision-making principles in relation to major events. We put their views into the Framework to make informed judgements over event viabilities in meeting sets of predetermined requirements, hence, to meet the various stakeholders' needs.

As with all case study research, defined by Yin (2018, p. 13) as an "investigation of a contemporary phenomenon within its real-life context", there is an emphasis on an openness and transparency. We displayed multiple sources of evidence, such as the detailed documentation of extensive research notes and policy and strategy documents, throughout the duration of the

research. So, extensive documentation was used as evidence and all meetings were recorded, transcribed and then minutes distributed for ratification by all stakeholders. Fourteen destination stakeholders were involved in the research process, with all sectors of the local tourism industry included at each stage of the research process.

Some of the elements in this system are the key stakeholders or the system actors as they are the participators of the systems thinking approach. The interconnections are the roles/functions they play; thus, bringing the overall system to life. So, in the case of events, their intangible and tangible roles within the overall event planning and management processes. The purpose or function is to make the decision-making processes more strategic, efficient, and effective, or making the right decisions in the right way. However, within this process, it is important to consider the interconnectedness and the process of synthesising and decision-making. Then, using this to feedback in a loop, iteratively, to improve and learn from the decision-making as they move forward. This decision-making process has become a *knowledge system* to the standard expressed by Midgley (2000, pp.76-88); it is a dynamic system.

Once the above had been completed for Organisations 1 and 2, the decision-making system was introduced and trialled in each Organisation. Organisation 1 has since implemented the approach and we consider them a viable system for events planning and management decision-making. Organisation 2 is continuing to trial the approach and will gather pace once their portfolio is fully established post-COVID. Organisation 3 is on hold until COVID allows us to meet and further scope their requirements.

The findings and discussion

All the case examples have shown that multiple levels of decision-making underpin any event decision(s) and each level of decision-making is bespoke to the destination in question and supports the findings of Sadd et al (2017). More specifically, depending on the existing structures of Local and Regional Government departments working with NGOs, will also impact on the number of different levels of decision makers needed, which aligns with the strategic approach asserted by Agarwal (2018) and Andersson et al. (2010). However, what is clear is the unnecessary levels of decision-making in each destination, so delaying and complicating the decision-making process, taking up valuable resources of time, manpower and money. In addition, the decision-making process is ignoring some of the key stakeholders who should be considered, as McKey (2019) warns.

All conceded that there are at present too many levels in place and the final say are often given at a level that is not really on the ground and actively managing and overseeing the portfolio of events. The levels add complexity and delays in making decision in an expedient manner. Further, to be able to adjust in a timely manner the nature and scope of the events they feel are lacking impact to satisfy the key local and regional stakeholders. Thus, consistent with the call of Antchat et al. (2019) and the need for systems to help evaluate events.

Each destination needs to learn and implement a viable system to be able to take away the unnecessary levels of bureaucracy. Systems thinking can undertake the initial scoping and presentation of viability to the committee that ultimately makes the final decision, as suggested by Sadd et al (2017). Thus, these committee decision makers will be satisfied that due process has been followed and the right decisions are being made based on sound judgements. Judgements informed by a system's interconnectedness and the consideration of all the components needed to make effective decisions. Decisions based on the needs of the key stakeholders as well having evaluated the different levels of decision-making stakeholders are involved with, as asserted by McKey (2019). However, a robust and inclusive process can only be feasible if the system's design is done with all stakeholders and approval then becomes a function of the system for all future event decisions (ibid, 2019). The viable system approach will need review at regular intervals in case the needs of stakeholders change but this should be on a pre-determined timeframe and not every time a small tweak is needed. Coincidentally, the latter was a recommendation of all three case study destinations. This then ratifies and gives credibility to the ultimate decision-makers, often council and other local government organisations, and applies to charities, funding organisations and the private sector. Thus, all could benefit from a viable system approach being incorporated into their events organisational decision-making processes and further recommendation of the case study destinations.

From the case study destinations, all three organisations now have the *five* higher and lower ordered decision-making levels influenced by Beer's (1972) Viable System model. However, the complexity of the different organisations means that the time frames and involvement of gatekeepers differ significantly. Yet, what is clear is that in each Organisation, at present, the final decision is being made by a different entity altogether, often based on the views of the level below and not through any insight from the key stakeholders and thus, not meeting their needs. Moreover, a body makes the decisions with different drivers and requirements, often economic; therefore, it does not help the destination satisfy its triple bottom-line measurements, as contested by Sadd et

al. (2017) and Antchat et al. (2019). Table 2 presents the levels of decision-making now in place for each destination. Plus, for Systems 1 to 5, we indicate the systemic changes for each case study due to applying the VSM-inspired FAME approach. Finally, a systemic analysis column also reflects on the implications for Systems 1 to 5.

The Viable System (Beer, 1972) model provides a blueprint for an effective organisation to uplift decision-making through Systems 1 to 5, so all five Systems have an input into the final decision-making process, as shown in all three examples above. We based our analysis on primary data from interviews and secondary data after reviewing documentation provided by each destination, where possible. All agreed that the development of a robust decision-making system that removes excessive levels and allows for the decisions to be more robustly taken and in a timely fashion is vital for measuring and maintaining a sustainable events portfolio, concurring with the positions of Sadd et al. (2017) and Andersson et al. (2020). As a representative from Case Study 2 aptly put it:

> *We often have to wait for county level decision making which considering how many other destinations they have to consider, mean that our needs from events often gets overlooked when evaluated against competing needs*

Any method developed to help remove many of these levels with the resultant time delays or complexities over competing needs can be personalised to meet the various stakeholders involved in the decision-making, such as FAME. By designing FAME using the logic of VSM (Beer, 1972), we have achieved what Harwood (2011) refers to as paradigmatic commensurability, which is also likely to help the destinations to develop self-sustaining or autopoietic (Maturana and Varela, 1980) events management systems. FAME also achieved double loop feedback (Sterman, 2000) necessary to promote deeper learning for systemic change.

Conclusion

It is clear from the successes seen in Organisation 1, that the adoption of a Systems Thinking (Checkland, 1981) approach to the decision-making process has been ratified and supported by all the key stakeholders. They have gained expediency in their decision-making processes and most importantly developed and helped design events that are worthy of national awards. Feedback included

from the Events Director for Organisation 1 stated, "the award winning XX event would never have been supported at the highest level without the underpinning of the FAME method and Report". The FAME framework has now been used to evaluate four major events and the results from the systems thinking approach (ibid) showed areas that needed further development before they became viable events to meet their stakeholder requirements.

By using the systems thinking approach any issues around the future viability and on-going support of these events, including any financial underwriting, can be highlighted so that the events are developed in-line with the overall portfolio in mind. A sustainable events portfolio is now more important as ever with the re-emergence of events post the pandemic. A review of any destination's events strategy is crucial to align with the strategic direction the destination wishes to follow. The key objectives of the destination and its stakeholders will be central components of the event framework and any associated systems thinking approach, such as the use of VSM (Beer, 1979) with FAME.

The viable systems 1 to 5	*Case study 1*	*Case study 2*	*Case study 3*	*Comparative analyses*
S1, concerned with implementation, consideration of competitors, customers, markets	Robust application process for events as Local Government controlled via an application process that covers S1 concerns, i.e., purchase, delivery, and evidence of value production	Centralised application process if financial support requested. Limited opportunity in organisations current design to specifically cover value production unless via funding application	Clear strategic drivers in place due to centralised approach to event portfolio, considering environmental scanning and future proofing through a more robust application system	The differences arise from the nature of the Organisation and the level of permissions required. If an NGO, rather than LGA, the implementation conditions vary. Thus, the transformation varies.
S2, coordination of S1	Controlled within central team as one point of contact to co-ordinate and control	As an NGO, powers limited in relation to event viability; however, controlled	Controlled within central team as one point of contact to co-ordinate and control	If the Organisation has the final say in the event viability, then the coordination

	communicatio n	within central team as one point of contact to co-ordinate and control communicatio n	communicatio n	is more easily centralised. As an NGO, without permission rights, this is less easy on events
S3, control function and internal stability – optimisation of the Organisation	Use of FAME that includes controls through structures rules, resources and responsibilitie s that must be met for event viability	FAME in existence, but limited application to date, yet optimisation of the Organisation is key	FAME to be developed to its full potential	FAME is the system to allow for control and stability. Without S3, S4 and S5 it is impossible to follow plans
S4, intelligence gathering and reporting	Pre, during and post event analysis reported, included environmental scanning and future proofing of event	Available for events only that fall under their remit; however, environmental scanning is a crucial part of future proofing.	Pre, during and post event analysis recommended	Information gathering is complex depending on the Organisation and must be considered as a part of the event permissions
S5, policy and strategy	Clear strategy for event development aligned to destination strategic drivers incorporated (reviewed) in FAME	Still a work in progress but it is becoming clearer what the strategic event drivers need to be	Clear strategy for event development aligned to destination strategic drivers	All are clear a strategic approach is needed, and policies to be implemented via FAME that can be adapted for strategic focus.

Table 2, the levels of decision-making now in place for each destination Source: authors

This paper has shown how systems thinking can help to design and more to bespoke approaches to events decision-making to make it more expedient, yet still designed to support the key stakeholders' objectives. A 'one size fits all' Framework, as offered by some destinations in the UK, will not meet the distinctive demands of these destinations as they often rely on their unique product offer.

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Book Review

MINDWARE – Tools for Smart Thinking
Richard Nisbett (University of Michigan,) Allen Lane 2015
A Review

Neil Richardson
Kirkheaton
West Yorks

Professor Nisbett's hardback reminds me of folk who seem incredibly keen about Yuletide, the sort who start shopping in June; by early November they have wrapped numerous classy gifts for each relative. Come Christmas Day, consider how part-time bar worker Mary gives £3 worth of thermal gloves to Uncle Joe before receiving in return his expensive choices, artfully tucked into a splendid seasonal carrier bag. Like embarrassed Mary, I cannot match Nisbett's erudite offering. But wouldn't it have been smarter for Mary and Joe to exchange fewer gifts, and then enjoy end-of-year parley?

The book's dust cover describes the author's ground-breaking book as 'a lightning tour of human reasoning' that will transform the way we solve problems…a toolkit that allows you to think differently about things that crop up in everyday life. However, readers unfamiliar with the hundred or so tools appearing in Nisbett's six-part structure might need to spend more than a week of their Yuletide absorbing all two-hundred and forty pages of Mindware, from Part 1: Thinking About Thought to Part VI: Knowing the World.

Three chapters in Part 1 acknowledge that the ideas which follow stem from a wide range of subjects. Nisbett does not pretend to have designed the tools, concepts and inferential principles discussed, all apparently able to supplement common sense. What, no uncommon issues over the cliché common sense? We're advised to ponder over the situation first: don't miss the importance of context; the emphasis is (or ought to be) some school, factory, or open-plan office rather than a person's dispositions, tastes or abilities.

However, isn't the social variety within any group part of the context, and such context (as they see it) frequently changing, given that we should not assume a person's behaviour in two or three situations necessarily predicts future

behaviour – folk change. After reading several interesting psychological experiments (like bystander intervention and a TV quiz show format), readers might still be looking around for tools to help pay more attention to their local issues and how they get discussed. Beyond common sense, how do they appreciate, record, and discuss context? Part 1 ends with a warning: Don't assume that you know why you think what you think or do what you do. Not even crossing a busy road, adjusting a domestic thermostat, or proof-reading one's ground-breaking book?

Logic appears via chapter thirteen to introduce Venn diagrams, ancient syllogisms (all men are error prone, Socrates is a man, etc.) and the infrequent hurdle of interpreting rules when four cards have been marked with numbers on one side and consonants/vowels on the other. Which cards must be turned over to check rules have been followed? Yes, motivating for short periods if media networks are on strike, but why does this type of logic – occasionally overwhelmed by real-world complexity - appear when other sorts might be equally relevant to readers, conceivably the logic of a domestic budget, Excel spreadsheets, or academic practice during a newcomer's first term at university?

Items assembled in 'Mindware' are likely to win applause from those attracted to the Sunday papers' quiz section: word games, crosswords, commercial algebra, unlock a notional strongroom safe, and so on. It may also gain five-stars if your formal studies overlap psychology, sociology, or philosophy – for such aficionados, the book's index refers to intriguing topics like 'hypotheses – ad hoc and post hoc, causal, confirmation bias, and experiments testing'. Okay, perhaps my subconscious should have been more charitable about Nisbett's wide-ranging talent. Joyeux Noel!

Neil Richardson
Kirkheaton
West Yorks.

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