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Augmenting the intuitive logics scenario planning method for a more comprehensive analysis of causation

James Derbyshire [a,*], George Wright [b]

[a] Centre for Enterprise and Economic Development Research, Middlesex University, UK

[b] Strathclyde Business School, University of Strathclyde, UK

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ABSTRACT

This paper shows that, in practice, the standard approach to scenario planning, known as 'intuitive logics', is overly focused on uncovering causes of one type, known as 'efficient cause'. We outline and apply a broader consideration of causes, leading to a more sophisticated analysis of uncertainty. Our focus is on the incorporation of Aristotle's nuanced analysis of causation. We incorporate the features of our augmented scenario development approach in a practical step-by-step methodology, and draw out several implications for expert knowledge elicitation.

1. Introduction

Scenario planning is a technique for thinking about the future that is employed widely by both business and government organizations. It is designed to broaden and challenge decision-makers' perspectives, allowing them to reconsider the standard assumption of 'business-as-usual' (van der Heijden, 2000; van der Heijden, Bradfield, Burt, Cairns, & Wright, 2002).

In a review of the literature, Wright, Bradfield, and Cairns (2013) found that the three main objectives of the application of scenario methods are to: (i) *enhance our understanding* of the causal processes, connections and logical sequences underlying events, thus uncovering how a future state of the world may unfold; (ii) *challenge conventional thinking*, that is, reframe perceptions and change the mindsets of those within organizations; and (iii) *improve decision-making*, so as to inform strategy development. Wright et al. (2013) emphasize that understanding the connections, causal processes, and logical sequences which determine how events may unfold to create different futures, will challenge conventional thinking and will also prove of benefit in improving organizational decision-making and strategies.

As such, scenario methods are often qualitative in approach rather than quantitative, and are targeted at providing, side-by-side, alternative views of the nature of a broad-brush future, where these views are elicited from problem experts within a scenario team. This approach is in sharp contrast to the common aim of expert knowledge elicitation (EKE) methods, where the focus is on quantifying experts' single-point estimates of uncertain quantities, with some experts' judgments potentially being given more weight in the combination (c.f. Aspinall, 2010; Bolger & Rowe, 2015; Morgan, 2014). Another difference between the scenario approach and typical EKE yields is that scenario planning has no objective standard against which to calibrate the validity of individual experts' judgments. In scenario planning, the focus is often on the distant future, and the scenarios themselves are not forecasts but very different alternative plausible futures that are intended to 'bound' the range of future possibilities, with each individual scenario (if thought of as an intersection of many events) having an infinitesimal likelihood of occurrence. In

* Corresponding author.
E-mail address: J.Derbyshire@mdx.ac.uk (J. Derbyshire).

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addition, scenario planning also combines individual expert opinion informally, often within a workshop setting. In such situations, the scenario team facilitator's role is to generate a divergence of opinions, before finally facilitating the convergence of these opinions into (usually) four scenario storylines. See Wright and Cairns (2011) and Wright et al. (2013) for more details of the scenario method.

There are a number of alternative approaches to scenario planning (see Bradfield, Wright, Burt, Cairns, & Van Der Heijden, 2005), but the one applied by far the most commonly is that known as 'intuitive logics' (IL); see Schwartz (1991), Foster (1993), and Vanston, Frisbee, Lopreato, and Poston (1977) for examples of the diversity within the IL approach. IL is a plausibility-based approach that enables participants, usually within a workshop setting, to create narratives that describe unfolding chains of causation, which resolve themselves into sets of distinct future outcomes, usually four (Goodwin & Wright, 2010; Phelps, Chan, & Kapsalis, 2001). Because it is based on plausibility rather than probability or projection, it is argued that a key advantage of IL over forecasting is its ability to facilitate the management team's consideration of challenging futures (Wright & Cairns, 2011; Wright & Goodwin, 2009).

Bradfield et al. (2005) identified four main areas of usefulness of scenario work: making sense of a particular puzzling situation; strategy development; anticipation; and adaptive organizational learning. The flexibility of the IL method lends itself to a wide range of scenario purposes, whether descriptive or normative, the scope of which can be either extremely broad, as in the development of global scenarios, or narrow, if focussed on the viability of a single focal organization. See Wright and Cairns (2011) for a discussion of the importance of defining an 'issue of concern' clearly at the start of any scenario enquiry. The present paper's discussion focuses on the causes of transformation in the business environment, and therefore we consider our arguments and conclusions to be applicable to all purposes that are inherent in scenario work.

Recently, the effectiveness of IL in providing the benefits of both understanding causality and challenging business-as-usual thinking has been questioned (Wright et al., 2013). In addition, IL has been shown to be deterministic (Derbyshire & Wright, 2014), in that 'surprise' futures that have no salient causal linkage to participants' present viewpoints are not considered. Reflecting this inherent determinism, IL has been shown to increase the focus on the scenario workshop participants' perspectives as to the full range of plausible futures, which may be overly narrow (Wright et al., 2013). Finally, the IL method has been shown to lead to an increased confidence in views of causality that may be mistaken (Wright & Goodwin, 2009).

The present paper argues that many of these problems stem from a contradiction that is at the heart of IL. Specifically, it purports to be a technique for thinking about the future that eschews prediction; yet, in practice, its foundations can be viewed as being built upon a predominant focus on causes of one type, known as 'efficient cause'. As we shall argue, this over-focus on efficient cause is one of the main factors that leads IL to narrow decision-makers' perspectives as to the range of plausible futures, rather than broadening them, as intended.

We argue that, in order to resolve this contradiction, it is necessary to rethink the IL approach to developing scenarios, such that it does not narrow the perspective by focusing on only one type of cause. A nuanced and sophisticated attempt to grapple with the inherent uncertainty of the future requires us to consider as full a range of *different* types of causes as possible, and to be aware of the conditions under which identified causes lead to unexpected outcomes, due to contingent conditions or countervailing factors. We outline the underpinning logic for, and practical application of, augmentations of the current 'standard' approach to IL so as to enhance the analysis of causality. Our focus is on the incorporation of Aristotle's nuanced analysis of causation.

In the next section of this paper, we provide an overview of the conventional IL scenario development process and demonstrate its reliance on the identification of efficient cause. Section 3 then shows the limitations of this focus. Section 4 demonstrates how the scenario development methodology can be augmented to take into consideration a much broader set of causes. Finally, Sections 5 and 6 develop and demonstrate a practical augmented IL scenario development process which incorporates the broader cause set. Thus, our paper enhances the analysis of cause within the scenario process.

2. The current foundations of scenario development

2.1. The 'standard' IL approach to scenario development

While there are many different approaches to scenario construction, Postma and Liebl (2005) have shown the predominant approach to be that known as 'intuitive logics' (IL). Following Ramirez and Wilkinson (2014), the present paper refers to IL as the 'standard' approach to scenario planning.

In chronological order, the approach requires the scenario team members to identify an 'issue of concern' at Stage 1, and predetermined elements and critical uncertainties at Stage 2. This identification is initiated by asking the scenario team to consider each of the six PESTEL dimensions in turn (political, economic, social, technological, environmental, and legal). These separate driving forces, of which there are often over 200 in a typical scenario exercise (c.f. Bradfield, Cairns, & Wright, 2015; van der Heijden et al., 2002; Wright, Cairns, & Goodwin, 2009), are then re-composed into clusters of 'related' forces, at Stage 3. This clustering is achieved across the PESTEL dimensions by linking individual forces through 'arrows of influence' (as is illustrated in Fig. 1).

This allows the generation and naming of causally-linked clusters of elements that are largely independent of one another. In Stage 4, two 'extreme' but plausible sets of outcomes are defined for each of the clusters. Stage 5 involves the identification of those cluster headings that combine: (i) a high impact on the focal issue of concern (usually the viability of the host or focal organization), and

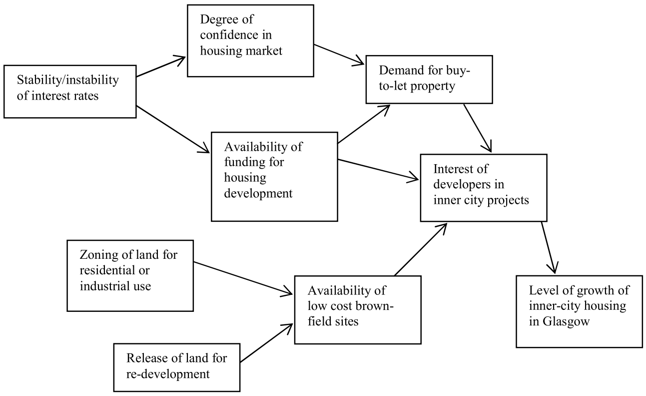

Fig. 1. Example of an influence diagram produced at Stage 3 in a 'real-life' standard IL scenario planning exercise.

(ii) a high uncertainty. At Stage 6, the two cluster headings with (a) the greatest impact and (b) uncertainty over what that impact will be, are selected as the 'scenario dimensions' that are utilised for the production of four detailed scenarios, which are developed with a common temporal starting point, but end in four diverse, yet plausible, causally-unfolded end-states. (A full illustration of the practicalities of each of these six stages, and their outcomes, in tutorial fashion is given by Wright and Cairns (2011); to save space, we do not repeat this material here). It is after this point that the scenario development may focus on a stakeholder analysis: what would each of a set of stakeholders (e.g., competitors, regulators, customers, suppliers, etc.) do to preserve or enhance its own interests as a particular scenario unfolds (van der Heijden et al., 2002)? This optional ingredient of the scenario mix is perceived to add a degree of realism to the scenarios. If the focus of the scenario exercise is strategy development, another possible stage is to evaluate the organization's strategies (which have previously been kept separate and distinct) against each of the scenarios. Is a particular strategy robust to a range of scenarios, or is it fragile against some? This focus often leads to either (i) a re-design of strategic options or, more fundamentally, (ii) a re-design of the success formula of the organization.

It can be seen that the emphasis in scenario planning is on uncovering the causal nature of the unfolding future. As Burt, Wright, Bradfield, Cairns, and Van Der Heijden (2006) note, scenarios are not predictions, extrapolations, good or bad futures, or science fiction. Instead, they are purposeful stories about how the contextual environment could unfold over time, and consist of the following:

1. *A description of a future end state in a horizon year* — that is, the combinations of uncertainties and their emergent resolution at the final point in time in a particular scenario story.
2. *An internally consistent account of how a future world will unfold* — that is, an explanation based on causal logic as to how a particular scenario will unfold from the past and present to the future. The story will represent the dynamic interplay of predetermined elements and resolved uncertainties, showing how these factors are interconnected and impact each other, thus revealing their logical consequences.

Wright and Cairns (2011) document such a causal analysis using data from a recent scenario planning intervention, conducted by one of the present authors, in a major EU bank that was involved in residential mortgage lending in the last quarter of 2007. Two cross-disciplinary clusters that were viewed by the mortgage business' senior managers to be of both (i) the highest uncertainty and (ii) the highest impact on the bank's operations were illustrated. One cluster evidenced the bank's concern with residential house price rises – a factor which was seen to be a pre-determined trend – and the effect of this on the ability of mortgage applicants to service their debts. The view was that these borrowers would be attracted to 'multi-generational mortgages', where the debt is passed down to succeeding generations. The second cluster evidenced the bank's concerns with supermarkets offering mortgage products, since these retailers already offered savings accounts and credit cards. In short, and importantly from the perspective of the present paper, a conventional application of the IL methodology made no prompted analysis as to what the scenario participants thought could radically transform the bank's then-current mortgage-lending activity to make it either more or less successful.

Thus, scenario planning is designed to be an organizationally-based social-reasoning process, based on dialogue and conversation, allowing participants' perceptions of the environment to be shared and facilitating participants' interactions as they engage in a process of sense-making through theory building and storytelling. The emphasis of the elicitation process is, simply, on identifying 'cause'. However, in practice, cause is left undefined (c.f. Bradfield et al., 2015; van der Heijden et al., 2002; Wright et al., 2009), and as such, workshop participants use the proffered 'arrows of influence' in an unsophisticated, simplistic way, as is shown in Fig. 1; i.e., loosely and without specific direction by the workshop facilitator.

It should be noted that an 'arrow of influence' indicates that the outcome of one particular (i.e., part of a cluster) driving force (positioned at the start of an arrow) occurs earlier in time than, and influences the resolution – as an outcome – of, the particular driving force that is positioned at the point of the arrow, representing a point that is later in time. A further arrow then leads from this resolved driving force to a subsequent one which is still later in time,

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and so on, until an end-point is reached. Thus, in the abstract, a cluster of driving forces may potentially represent several sequences of future outcomes. Therefore, IL is based on constructing a series of cause-and-effect relationships that lead to individual sets of future outcomes, in a time-ordered sequence. The type of causation in which earlier occurrence precipitates and brings about a later occurrence, in a chronological sequence of cause-and-effect (van der Heijden, 2000), is known as 'efficient cause' (Hocutt, 1974).

This – perhaps natural and unthinking – emphasis on forces as being efficient causes shows IL practice to be aligned with the Newtonian perspective on forces, which is referred to as 'Newtonian mechanics', and, as its name implies, views systems as operating in an inherently mechanical fashion (Byrne, 2002; Orrell & McSharry, 2009). Newtonian mechanics has its origins in nineteenth century physics, in which it was conceived as a system for identifying how objects move under the influence of force (Byrne, 2002). As is evident from the use of calculus in modern-day neoclassical economics, which is also founded in mechanics (Mirowski, 1989), this approach to reasoning assumes that if a system's current coordinates in state space can be pinpointed with sufficient accuracy, its future coordinates – and, indeed, all of its past coordinates – can be known too (Byrne, 2002; Makridakis & Taleb, 2009; Orrell & McSharry, 2009). This implies that a unique set of input coordinates leads to a single, unique outcome in terms of the future position of the system, thus making prediction possible. For example, positions within the planetary system over time can be predicted with precision (Makridakis & Taleb, 2009).

Under Newtonian mechanics, a particular point in a system's trajectory leads to a particular subsequent point, in a sequential (and entirely reversible) fashion. Thus, each future position of the system is fully determined and fully reflective of its current position, and there is only one unique path to each individual future position of the system. Similarly, each scenario developed in IL represents a single set of antecedent (driving) forces, each of which leads to a distinct, individual outcome via a sequence of cause-and-effect relationships, whereby each 'resolved' cause (i.e., driving force) precipitates another outcome in the chain until the sequenced outcome of the chain is realised. Such a sequence of cause-and-effect relationships is illustrated in Fig. 1. Note that, from the 'efficient cause' perspective on causality, a knowledge of the chain's causes implies a knowledge of the chain's ultimate outcome, meaning that, logically, it should be possible to identify an 'early warning' or 'weak signal' (Derbyshire & Wright, 2014; Ramirez, Osterman, & Gronquist, 2013; Schoemaker, Day, & Snyder, 2013). Here, an 'early warning' would be the occurrence of a particular outcome at an early stage of the pre-identified, sequenced chain of driving forces.

In recent years, many organizations have seen a strong growth in 'horizon-scanning' activities and functions; see for example horizon scanning by health organisations in the UK and elsewhere.[1] However, others have viewed such activities as being less than straightforward. For example, Poli (2010a,b) has persuasively argued that systems (in our case, individual actors or societal structures, where the latter include regulation, laws, etc.) make or contain predictions of the future in their *current* decisions/formulations. Similarly, the non-orthodox economist G.L.S. Shackle (2010) wrote widely on the role of expectations in current decision-making. Thus, anticipated future states influence the current state of a system, which contradicts Newtonian models.

2.2. IL's contradictory foundations

Our analysis (c.f. Wright & Goodwin, 2009) has shown that the future is not driven solely by the systemic actions of driving forces abstracted from a PESTEL checklist (c.f. the standard IL scenario development methodology, above), but also involves the actions of human beings, as they react to the unfolding of outcomes. Human action, or inaction, increases the complexity of our understanding of the ways in which the future might unfold. However, this realisation of the primacy of self-interested human action/intervention is a quite recent addition to the scenario literature (c.f. Cairns, Śliwa, & Wright, 2010; Wright & Goodwin, 2009). In short, standard IL, as currently constituted and outlined earlier, is grounded in foundations that imply prediction. This inherent determinism, as well as the problem of an over-emphasis on efficient cause, will be analysed further in the following sections of this paper.

We argue that IL's current foundations need to be rethought and augmented with measures that are aimed at mitigating the negative and bias-inducing effects of an over-focus on the identification of efficient cause. We show that this can be achieved by enhancing the current standard IL process using concepts (and derived practical steps) from Aristotle's philosophy of cause (Aristotle, 195). We clear the ground for this discussion by further developing our analysis of the positive and negative aspects of scenario planning's current emphasis on the identification of perceptions of efficient cause-and-effect relationships, as evidenced by the multi-stage standard approach set out above. We then highlight alternative understandings of 'cause' that provide for a more comprehensive analysis of causation, when incorporated into a practical scenario-creation process.

3. Standard scenario planning and causation

3.1. Positive aspects of a focus on efficient cause

The process of constructing several sets of efficient cause-and-effect relationships is beneficial in itself, as it provokes participants to consider futures other than 'business-as-usual' — i.e., other than a simple extrapolation of the present into the future. Essentially, this re-framing effect is brought about through what is called the 'simulation heuristic', which Tversky and Kahneman (1983) have shown to occur when people are asked to create narrative scenarios about the future. When an individual simulates (imagines) a causally-connected chain of outcomes, he or she will perceive the resulting set of time-sequenced

[1] For horizon scanning exercises conducted for the UK National Health Service, the World Health Organisation and other health-related bodies, see http://www.cfwi.org.uk/our-work/horizon-scanning.

outcomes (i.e., a particular scenario) psychologically to be much more likely to occur than the actual probabilities attached to the occurrence of the individual outcomes allow, according to the intersection probability law.

The simulation heuristic is the basis on which IL has its positive, perspective-broadening effect, since each scenario constructed (i.e., a set of sequences of outcomes), while standing in contrast to a simple extrapolation of the present, is still perceived to be a plausible unfolding of its constituent events. The simulation heuristic is an integral part of the effectiveness of the IL process, and a foundation stone for its usefulness as a tool for considering alternative futures. This heuristic is invoked in fully-developed scenarios by the use of narratives that describe the distinct sets of outcomes as chains of efficient causes.

3.2. Negative aspects of a focus on efficient cause

3.2.1. Determinism

Nevertheless, this positive, perspective-broadening effect of the use of efficient cause in the standard IL approach to scenario planning is balanced by several negative effects. Counter-intuitively, these act to *narrow* participants' perspectives on the future, rather than broaden them. As has been discussed, the use of unfolding chains of efficient causes means that each scenario is determined individually. Each outcome precipitates the next in a sequential, deterministic manner, resulting in a single set of future outcomes (Phelps et al., 2001; Raubitschek, 1998). Since each driving force may have more than one possible outcome (c.f. Stage 4 of the standard IL approach, described earlier), four sets of such outcomes are essential for the construction of four separate, individually-determined scenarios.

However, this simplicity in construction gives the misimpression that each end-state of a scenario has only a single set of antecedent causes. For example, the end-state of the cluster in Fig. 1 is a particular 'level of growth of inner-city housing in Glasgow', UK. As a result, applying the standard IL methodology gives the misimpression that, when such is an end-state, all that is necessary in order to avoid undesirable futures is to be alert to the occurrence of a particular sequence of events, and, if such unfold, to take action to avoid the undesirable outcome described by the scenario. Indeed, as has been discussed, this is the logic that lies behind the current emphasis on 'weak signals' and 'early warnings' in both the scenario-planning literature and organisational horizon-scanning functions (Derbyshire & Wright, 2014; Ramirez et al., 2013; Schoemaker et al., 2013).

For example, Schoemaker et al. (2013) considered the issue of scenarios being oriented more towards recognising and responding to 'weak signals' – i.e., trigger events that indicate and initiate the unfolding of a causal chain of events – in the external environment. These authors argued that contemporary, highly networked, organizations have extensive points of contact with the external world, but that this, while expanding the opportunities for recognising emergent opportunities and threats, also poses the threat of leaving the organization unable to spot useful signals amongst the 'avalanche of data'. They outlined an approach to seeking out such useful signals from among background noise that was based on the adoption of a 'strategic radar system', and illustrated the approach with a brief case study of a large government agency. In a similarly-focussed approach, Ramirez et al. (2013) used case examples from Nokia and Statoil to document the relationship between scenario development and the monitoring of early warning signals in a business environment. In their case analysis, these authors explored the degree of synergy between these two activities, and argued that the combination of activities can create a potential competitive advantage by providing top management with a continuous strategic service, in contrast to the discontinuity that is often inherent in a sequence of scenario exercises.

However, our analysis includes not only multiple possible futures, but also *multiple possible paths to each future*. Each future end-state, such as a particular 'level of growth of inner-city housing in Glasgow', has *multiple* possible sets of antecedent causes. The application of IL does not preclude the identification of multiple causal sets of antecedent causes; however, it is important to note that this realisation that there may be multiple possible sets of paths to a single future is unrecognised within the practical application of the IL approach to scenario development, where the focus of elicitation and analysis is on the identification of a single set of causal relationships (Wright et al., 2009), and has not been emphasised in any of the other approaches to scenario development that we have reviewed (Bradfield et al., 2005). Crucially, it follows that, since there are multiple possible sets of paths to any particular future, actions that are designed to sensitise an organisation to the early trigger events that initiate a single causal set of relationships that result in a particular (un)desirable future – so-called 'horizon-scanning' functional units – are misplaced. Thus, the uncertainty associated with the future is much more complex than that implied by IL in its standard format with its practice-based focus on efficient cause. As we shall see, IL's focus on efficient cause renders it overly deterministic, and thus capable only of facilitating a simplistic analysis of uncertainty.

With a similar emphasis on inappropriate simplification, Miller (2007, 2011) and Rhisiart, Miller, and Brooks (2015) make the point that we should not attempt to make probabilistic predictions of the future via high/medium/low variations on a single theme, such that we should not attempt to 'colonise the future' with our perceptions of the present-day. Ahlqvist and Rhisiart (2015) and Slaughter (1998, 1999) also argue that, when developing scenarios, we should be aware of the simplifying 'paradigmatic' assumptions and world-views that are prevalent in particular futures methodologies; in our view, this includes the very basic causal analysis that we have highlighted within the standard IL approach.

3.2.2. Increased focus on futures caused by ill-defined external shocks

Since the scenarios created in IL describe series of causes which trigger other causes, the causes that are considered to initiate the causal sequence often represent external 'shocks'. For example, consider the initial driving

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forces in Fig. 1: two are political local government decisions (i.e., land release/zoning) and one is stability/instability in interest rates, the pre-cursor of which could be change in global financial systems. In practice, such an external causation, which is often conceived as a weakly-specified change in the basic PESTEL dimensions, is often conceptualised by scenario workshop participants as triggering chains of efficient causes. This is because any deeper analysis will be both time-consuming and difficult. For example, consider a hypothetical scenario-planning exercise that is designed to consider the future of the UK economy, or one particular part of it, such as financial services (Cave, Derbyshire, & Yaqub, 2012). The development, by workshop participants, of precipitative chains of causation (c.f. stage 3 of the standard IL process, detailed earlier) will prompt a consideration of efficient causes as external shocks to the system under scrutiny, rather than deeper-lying, endogenously-generated causes. The result will be the generation of both questions based on precipitative, efficient causes, such as 'What might precipitate another financial crisis?', and answers that are also based on efficient causes, such as 'A series of speculative bubbles and crashes' (c.f. Cave et al., 2012).

The emphasis demonstrated in this example is on efficient cause, but the 'cause' is demonstrably poorly understood, being simply the inflation and bursting of a series of bubbles. This poorly-specified 'cause' leaves unexplored the deeper, underlying reasons for the inflation of such bubbles, including the contradictions that are inherent in the financial system and are brought about endogenously from within the system itself. Even when these causes are developed more fully, as in the example cited (Cave et al., 2012), the tendency, in practice, is for participants to focus on superficial, precipitative, trigger causes, rather than elaborating the underpinning generative mechanisms which create the conditions under which such triggers have their precipitative power.

Thus, a focus on efficient cause in practical scenario workshop settings can lead to only a shallow consideration of the causal unfolding of particular futures in terms of precipitative events, rather than a deeper consideration of the particular system under scrutiny, which underpins an event's precipitative power. Such superficial analyses can result in misattributions of cause (Wright & Goodwin, 2009).

4. How can scenario development methodology take into consideration a broader set of causes?

4.1. Incorporating a full range of Aristotelian causes

Aristotle's philosophical investigations (Aristotle, 195) showed the issue of cause to be more complex than the notion of efficient cause. Intuitively, if *A* causes *B* then *A* precedes *B* in time and brings it about. Thus, *A* is implicated directly in the occurrence of *B*, which would not occur in its absence. Here, 'cause' is simply a relationship that connects events (De Rond & Thietart, 2007) which occur in chronological order. However, efficient cause is only one of the four main types of cause that Aristotle distinguished, known as efficient, material, formal and final. As has been noted, a cluster of driving forces, as created in Stage 3 of the standard IL scenario development method, is highly dependent on a linear, chronological view of causes as series of precipitative events. However, a focus on this type of cause involves leaving the material, formal and final causes unexplored.

4.1.1. Material cause: cause as a transformation

The original Aristotelian conception of 'material cause' is named as such because it refers to the material from which something is made (Hocutt, 1974). An object's material nature determines (i) its present state, (ii) the states to which it can transform, and (iii) the effects that particular causes can have upon it. For example, the material nature of wood means that its present state is solid; however, burning causes it to transform into ash, which is a qualitatively different material state. Note that this is a step change to a different state, rather than a change in the variable level of a present state. Similarly, the material nature of water means it is liquid in warm temperatures; however, freezing temperatures cause it to transform into ice, which is again a qualitatively different material state, rather than simply a variable change in its present state.

Importantly, IL's standard method of identifying efficient cause is not concerned explicitly with the causes of a step change leading to transformation. In Aristole's analysis, on the other hand, material cause is of a focal importance in understanding change. The nature of the material cause of transformation from one qualitative state to another in our context, and the importance of identifying it, were illustrated by Fushing, Jordà, Beisner, & McCowan's (2014) recent examination of the cause of the 2008 financial crisis. These authors demonstrated that the 2008 financial crisis was the result of a sudden, unintended, system-wide loss of inter-banking network connections. The nature of the network linking banks had shifted over time from one that was characterized by a strong hierarchical control of transactions which was centered around particularly powerful individual banks, to one in which the control of transactions was distributed much more widely. This change in the control of the underpinning financial network caused a material step change in the viability of the overall financial system: it collapsed in 2008.

Such observable step-changes in material states are associated strongly with the operation of complex systems (c.f. Orrell & McSharry, 2009). Complex systems tend to remain on particular trajectories or 'paths' over time, until a point is reached at which the non-linear interactions between particular causal factors, which often originate endogenously but are fed back by the broader system in which they occur, cause a sudden shift onto an alternative development path. This change is represented as a 'tipping-point' or bifurcation (Byrne & Callaghan, 2014).

Wilkinson, Kupers, and Mangalagiu (2013) analysed how scenario development can benefit from the insights that complexity science can offer. A focus of their discussion was on the systemic influences that lead to non-linear shifts in the business environment. A key concept that they identified was that of 'feedback mechanisms', which will be dealt with in detail later, in Section 5.1.3.

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Wilkinson et al. argued that feedback mechanisms can act to magnify emergent systemic effects, thus amplifying their impacts. In our analysis, IL will provide little consideration of step-change and its causation, since the emphasis in the standard IL scenario development method is predominantly on efficient cause, with little consideration being given to material cause. Makridakis and Taleb (2009, p. 728) note explicitly that mechanical-based means for thinking about the future, as we have shown IL to be, are incapable of taking into account step changes, which they refer to alternatively as 'turning points'. However, as we have argued, step-change underpins the unfolding of significant, yet plausible, futures.

4.1.2. Formal cause: cause as design

A 'formal' notion of cause can have a number of interpretations, including natural tendencies or proclivities, and also formal blueprint or structure. Under the latter interpretation, 'formal cause' refers to what the object of causal explanation 'is', or is intended to be (Dimov, 2011), in its true essence. Thus, formal cause can be conceptualised as the formal design of an actor's or a structure's activities. For example, a local government's planning department will decide and regulate on land use in Glasgow city, within the influence diagram presented earlier in Fig. 1.

Plans or blueprints for action can be considered 'formal causes' (De Haan, 2006). From this perspective, the production of a newly built house is 'caused' by its formal blueprint, or the performance of a business is 'caused' by its business plan (Dimov, 2011). Thus, the designs of existing regulatory structures and strategic plans define and constrain the current and future activities of individuals and organisations. MacKay and Tambeau (2013) focused their conceptual analysis on the underlying basis of scenario construction, and identified enduring social structures – including cultural and economic systems that are governed by rules and resources – as the major determinants of human actions. In so doing, they integrated 'structuration theory' with the scenario method. Human actions are seen here as being both constrained and facilitated by existing social and economic structures, and these authors therefore argue that the interactions between human actions and such structures are pivotal to our understanding of the way in which the future might unfold.

4.1.3. Final cause: cause as motivated action

'Final' cause refers to the purpose or motivation underpinning behaviours. The recent scenario literature has seen an increased emphasis on uncovering stakeholders' viewpoints on unfolding events (Cairns et al., 2010; Wright et al., 2013). Hughes (2013) focused his analysis on the influence of scenarios on public policy making. He argued that public policy makers are often powerful, and can therefore shape and secure the future to a extent. This level of power is in contrast to the level of power that can be exerted by commercial organizations, with organizations often seeking protection, or robustness, in strategy development and evaluation. Hughes' analysis identified the inter-relationships between the behaviours of powerful, self-interested actors and the components of unfolding scenarios. He was concerned with the balance of both power and interests (i.e., desires and values) between actor groupings, as these forces interact with technological capabilities and technological change. In our analysis, powerful stakeholders will act to preserve and enhance their own interests within particular unfolding scenarios. However, the standard IL approach has been shown to have only a very limited emphasis on stakeholder concerns and predictable self-interested actions (Cairns et al., 2010; Wright et al., 2013). Our analysis suggests that one reason for this is the standard IL method's over-emphasis on identifying efficient rather than final causes.

A consideration of power and the powerful is absent from the standard IL method of developing scenarios, yet power structures can either block or enable changes that are instigated by efficient cause. Considering formal cause allows an understanding of individuals' or organizations' designed-in responsibilities and power to be obtained. Considering final cause allows us to increase our understanding of the motivation of an individual or organization to act, and therefore exercise power.

4.2. Contingent causation and countervailing factors

Each of these three alternatives to efficient cause – material, formal and final – can be incorporated into the standard IL scenario development process as an augmentation. Derbyshire and Wright (2014) cite Loasby (1999) as highlighting the provisional and tentative nature of all human notions of cause. This is due to countervailing factors, which may prevent a particular cause from having an effect. Recently, the UK National Health Service introduced a phone helpline that was aimed (formal cause) at reducing the patient burden on community-based general medical practitioners and hospitals. However, the employment of non-medically-trained call-handlers who followed tick-box scripts (formal cause), rather than qualified doctors or nurses who could employ judgement (formal cause), resulted in an increased burden on hospitals (efficient cause) since callers who did not receive credible advice were motivated (final cause) to seek expert advice from a hospital emergency department, overlooking the intermediate point-of-help, the community general practitioner. All of this resulted in several hospitals being categorised as failing (material cause). This is an exemplar illustration of how causal forces may act as countervailing factors to prevent an expected outcome arising from a designed formal cause.

In short, an analysis and understanding of contingent conditions and countervailing factors is essential to a full realization of an unfolding future. An analysis of the interplay between the forces of efficient, material, formal, and final causes provides a comprehensive portrayal of the unfolding of future states of the world. As was noted in Section 1, Bradfield et al. (2005) identified four main areas of purpose in scenario work: making sense of a particular puzzling situation; developing strategy; anticipation; and adaptive organizational learning. The flexibility of the IL method lends itself to a wide range of scenario purposes: (i) either descriptive or normative, and (ii) with the scope

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Table 1
Contrasting the conventional and augmented intuitive logics approaches to scenario development.

Stage	Conventional IL approach	Augmented IL approach
Stage 1: Setting the scenario agenda	Defining the issue of concern and process, and setting the scenario timescale.	Developing a detailed analysis of the present (see Section 5.1.1) that incorporates the identification of the material, formal and final causes, as well as the efficient cause.
Stage 2: Determining the driving forces	Eliciting a multiplicity of wide-ranging forces.	Prompting the identification of the material, formal and final causes, as well as the efficient cause.
Stage 3: Clustering the driving forces	Clustering causally-related driving forces, testing and naming the clusters.	Focusing on transformation by prompting the identification of the material, formal and final causes, as well as the efficient cause.
Stage 4: Defining the cluster outcomes	Defining two extreme, but plausible and hence possible, outcomes for each of the clusters over the scenario timescale.	The extreme scenarios are likely to become more extreme because of the augmented Stage 3.
Stage 5: Impact/uncertainty matrix	Ranking each of the clusters to determine the critical uncertainties; i.e., the clusters that have both the most impact on the issue of concern and the highest degree of uncertainty as to their resolution as outcomes.	No change.
Stage 6: Framing the scenarios	Selecting two initial critical uncertainties to create a scenario matrix, framing the scenarios by defining the extreme outcomes of the uncertainties.	No change.
Stage 7: Scoping the scenarios	Building a broad set of descriptors for each of the four scenarios.	Prompting the identification of causal loops.
Stage 8: Developing the scenarios	Developing scenario storylines, including key events, their chronological structures, and the 'who and why' of what happens.	The scenarios are likely to emphasize radical transformational change because of the augmented Stages 3 and 7.

being either extremely broad, as in the development of global scenarios, or narrow, if focussed on the viability of a single focal organization. In our analysis, our focus on the various types of causes of transformation in the business environment means that our arguments and conclusions are applicable to all of the varied purposes that are inherent in scenario work (c.f. van der Heijden et al., 2002). In short, the elicitation of driving forces should be re-framed as a process of identifying the forces (i) that can cause step-change transformation, (ii) whose formal design can either facilitate or restrict change, and (iii) where actor motivations and actions can either facilitate or restrict change.

5. Augmenting the scenario development method

In this section, we outline some adaptations and augmentations to the standard IL scenario development process, in order to reduce the current over-emphasis on efficient cause. We demonstrate that these changes transform IL from a tool that, in practice, focuses predominantly on efficient, precipitative causes, to one that encompasses all three alternative types of cause that are outlined in this paper. We set out these adaptations and augmentations below, linking each to the analysis of a specific alternative cause. See Table 1 for an overview of our augmented IL approach.

5.1. Uncovering the material cause of transformations from a present state to a future state

As we shall see in the following proposal for an augmented Stage 1 of the IL scenario development process, an analysis of the past can provide clues as to the types of causal relationships that will tend to continue into the future in the focal system of influences. However, standard IL currently devotes little attention to the consideration of either the present state or how it has come to be.

5.1.1. Providing a detailed analysis of the present as a 'common starting-point' for scenario development

Stage 1 of IL, described earlier, focuses on uncovering the 'issue of concern' to the focal organization. Our analysis suggests that this focus should be developed so as to become a more integral part of the scenario-planning exercise, providing more context for the future. An expanded Stage 1 should provide a detailed description of the 'present state' of the focal system, which can then be used to underpin the development of subsequent scenarios, providing a common starting-point for each unfolding chain of causation that leads to sets of varying future outcomes. As a part of this rich description of the present state, efforts should be made to understand how this present has come to be, since this analysis will provide causal clues as to what may occur in the future. While future causes and outcomes may differ from those of the past, the past can nevertheless provide clues as to the types of causal mechanisms that are present within the focal system.

To achieve this, an augmented Stage 1 should take the form of a short exercise in which participants describe the present situation in detail, and highlight the causal factors that they consider to have led to the present situation. Specifically, participants should be prompted to identify the factors (i) that caused step-change transformation, (ii) whose formal design either facilitated or restricted change,

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and (iii) where actor motivations and actions either facilitated or restricted change. As currently practiced, IL does not take advantage of all of the benefits that can be derived from history. History is taken into account to some extent through the consideration of predetermined elements, but this focuses on things that remain the same over time, rather than examining historical change and its causes. Templates such as PESTEL (c.f., Section 2.1) focus on what is immediately salient at present, and provide little room for considerations of how things have developed over time to date, how one identified driving force may have gained in prominence over time, or how previous significant changes or surprises were the results of particular important driving forces. In standard IL practice, described earlier, scenarios are constructed as developments from the present, without any explicit consideration of the process through which that present came to be. However, future developments will be influenced by a continuation of the causes that underpin the present. Some of these underpinning driving forces will be trend-based. It is worth noting that one of the seminal founders of scenario thinking also placed a strong emphasis on uncovering continuing trends (c.f. Wack, 1985). The more recent decrease in interest on the continuing elements of the future is understandable, given that scenario planning is now viewed by academics and practitioners as an alternative to forecasting (van der Heijden, 2000). However, the present analysis indicates that focused search and analysis should emphasise the identification of endogenous change that is brought about from within the focal system itself. This will allow developments in the future to be reconnected with the present and past.

In many respects, we believe that this augmented approach, which incorporates a much more detailed initial stage, is more in keeping with the original intentions of scenario planning. While there has been an exponential increase in the literature on scenario planning (Hodgkinson, Whittington, Johnson, & Schwarz, 2006; Varum & Melo, 2010), van Asselt, van't Klooster, van Notten, and Smits' (2010) review of the wide range of scenarios that have been developed and documented in the literature concluded that most of the accounts of the development process were merely relatively short descriptions of the main steps. Consequently, 'choices, considerations, discussions, struggles, compromises, unproductive steps, flaws, practical adjustments, experiments, difficulties, challenges and local solutions are concealed' (van Asselt, van't Klooster, van Notten, & Smits, 2010, p. 11). In keeping with this, we contend that most of the accounts infer that the development process is relatively straightforward and linear; little attention is paid to segregating out what is predetermined and what is uncertain; and the nature of any perceived causality has been analysed only superficially. This includes any focus on the role of history in understanding how the present situation has come about and how it may evolve in the future. Thus, important causes of past significant changes and their potential to be repeated, albeit in different contexts, leading to subtle but important differences in the ways in which they play out, are therefore overlooked. To some extent, the scenario process has become a somewhat simplistic, off-the-shelf tool which allows management to 'tick the box' in terms of future-proofing and a consideration of the future. The simplistic way in which the IL process has been documented in the major practical textbooks (see, for example, van der Heijden et al., 2002; Wright & Cairns, 2011), though with the good intention of widening access to scenario practice and invoking discussion, may have contributed to this inadvertently.

The process of creating a detailed description of the present, within an augmented Stage 1, will also provide a preliminary perspective on varying stakeholder views of the focal system as it currently is. Such views may be positive, negative or indifferent. The standard IL process includes nothing that provides for the uncovering of these varying interpretations of the present state, other than the initial discussion in Stage 1 of the 'issue of concern' for which the scenario-planning exercise is being conducted.

5.1.2. Enhancing the influence diagram to make it more explicitly about transformation

The detailed description of a present state that results from an expanded Stage 1 should be referred to at the point in Stage 2 when the driving forces are created. This would reinforce participants' understanding that the process that is being considered involves continuation as well as change, resulting in more emphasis being given to the identification of pre-determined elements, as opposed to uncertainties.

The influence diagrams developed at Stage 4 of the standard IL scenario development process start with 'fundamental' drivers (i.e., forces that are linked closely to the basic PESTEL categories) on the left-hand side of the diagram, whose 'arrows of influence' are directed from one subsequent cause to the next in a left-to-right direction, until the end-point, which is usually to the right of the diagram and represents the resolved outcome, is reached. Including a brief analysis of the present state to the left of the diagram allows the newly developed influence diagram to reinforce the scenario as one of stability, and changes the focal system from the present to the future. Furthermore, this inclusion of a common starting point facilitates the comparison of different influence diagrams, thus providing the context within which to consider the plausibility of alternative unfolding causal paths to the future from a commonly-agreed present. This can also assist in deciding on the placement of the clusters in Stage 5, the stage which determines the essential basis for the narrative scenarios.

Including present-state descriptions can also assist with the actual writing of scenario narratives in Stage 8, since it is easier to set out the scenario story-lines in terms of explicit start and end points. The left-hand side of Fig. 2 provides an example of such an augmented influence diagram for the level of growth of inner-city housing in Glasgow that we presented in Fig. 1 for the original approach.

Indeed, the housing strategies of local authorities in the UK, as incorporated in the example in Fig. 2, provide a further example, and one which is highly salient at present, as to why it is important to take into account the broad range of causes that we have argued for. As another, contrasting, housing example, consider the housing issue in London, which is located 350 miles south of Glasgow. A lot has been written recently about the 'housing crisis'

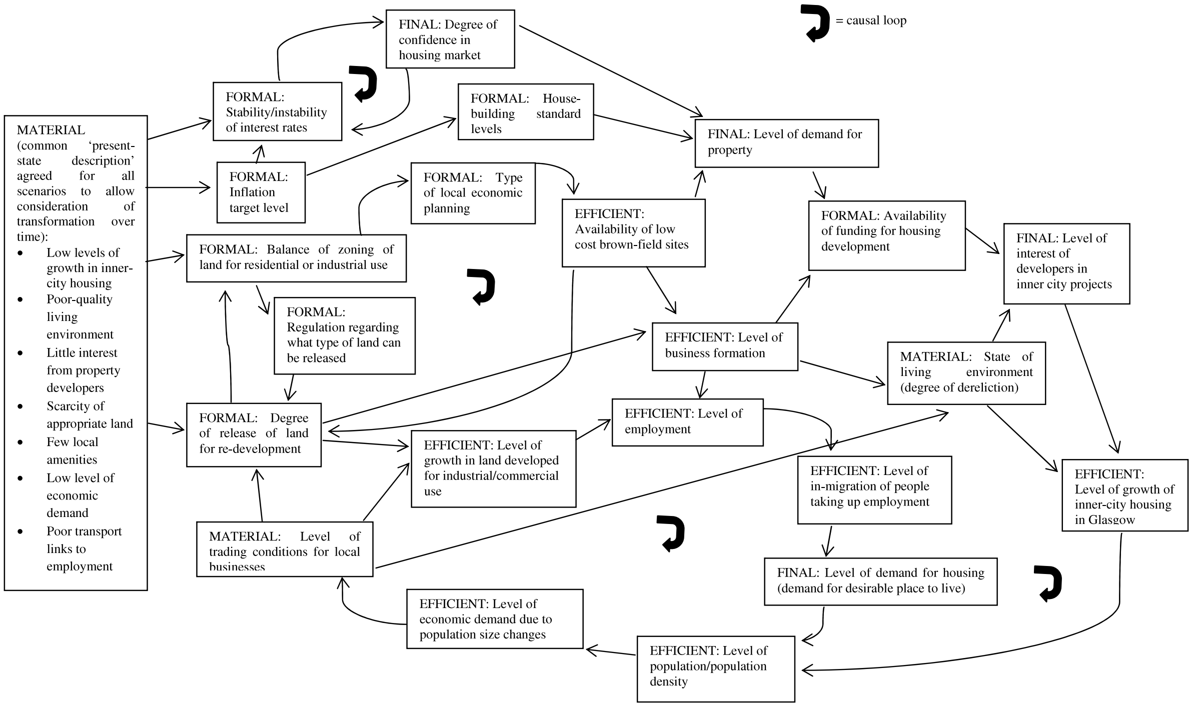

Fig. 2. An influence diagram from causally-augmented IL scenario planning.

that is facing London. There are a broad range of causes of this crisis, encompassing all four of the aspects of cause that we have highlighted: efficient, material, formal and final. A highly simplistic analysis based purely on efficient cause would perhaps identify sharp increases in rent as being the direct cause of the crisis, perhaps precipitated by an insufficient supply of new housing. However, a more nuanced causal analysis would unpick the underlying factors that are contributing to this lack of supply. As was discussed by Foster (2015), the causes of the housing crisis include the insufficient availability of land (material cause), which is exacerbated by planning regulations and bureaucracy (formal cause) that make it difficult to build on what little land there is available. The resulting constraint in the housing supply has now been exacerbated further by the UK government's 'Right to buy' scheme (formal cause), which allows tenants in local government social housing to purchase the property that they are renting. The theory is that local authorities will then use the money thus raised to build replacement social housing. However, as has been noted, some areas, especially in London, do not have any land available for this (material cause); also, elsewhere, the difference between the revenue raised from selling a 'Right to buy' property and the cost of building a new property is so large, not least during a period of austerity, that local authorities cannot afford to build the replacement property that is required (material cause). As a result, local authorities in London have had to return £250m in revenue raised from selling social housing to the central government, because they have been unable to spend it on building replacement social housing. Finally, these problems are exacerbated further by foreign investors buying property or land and keeping it empty or unbuilt on, simply as an investment, essentially banking the property or land and waiting for prices to increase. They are motivated to do this by the rapidly increasing land and house prices (final cause). This action by investors has the effect of increasing house prices further, making it still more desirable to buy and withhold houses and land, in the circular fashion of a causal loop, leading to transformation (in this case, the transformation from a situation of adequate supply to a housing crisis).

Of course, some of these causes in our London example above, or in our Glasgow example in Fig. 2, might be identified through a PESTEL analysis in any case (c.f. Section 2.1), and so picked up by a scenario planning exercise that employed the standard IL approach as it is currently constituted. However, stating the four different types of causes explicitly, and adapting the IL process specifically to uncover them, as described below, results in a greater likelihood of the full range of important causes being uncovered. Moreover, a consideration of the category of cause, as in the Glasgow example in Fig. 2, assists in the process of understanding how the various causes combine to bring about (in the London case) a negative transformation, and how strategies can be put in place to mitigate, or potentially reverse, the effects of this. The interactions between causes can be understood better when causal types are identified. For example, the 'cause' related to a sclerotic planning system and excessive bureaucracy might be mitigated by a one-off release of a large amount of available land, such as brownfield (i.e., former industrial land) or greenfield, through a planning process that is specifically designed to be minimal and to allow the release of this land for development as soon as possible. However, if the final cause of foreign investors' incentive to buy and hold on to development land is not addressed simultaneously, addressing the formal cause related to the planning system and its bureaucracy may do little to alleviate the problem. Resolving the problem, leading to a transformation back to non-crisis conditions, would require a combination of actions aimed at addressing each of the different types of causes, taken in combination. Understanding the natures of these different causes assists in thinking this through, and thinking through the effects on the other causes of actions that are taken to resolve one cause. An action that is taken to resolve one particular cause might actually exacerbate one of the other causes, causing the crisis to worsen rather than improve, because of complex and contingent causation, and the causal interactions this leads to.

5.1.3. Analysing the potential for transformation — material cause

As was noted above, the influence diagrams that are constructed as part of IL currently tend to consist of causes that are linked by 'arrows of influence' which run from left to right in a linear fashion, thus reinforcing IL's determinism, which we associated earlier with its focus on efficient cause. Causal looping, in which a cause and its effect are shown to influence each other, are not a common or standard feature in IL influence diagrams. However, we consider that the importance of causal loops should be expressed to scenario workshop participants explicitly, and that such loops should be included in influence diagrams whenever possible, in order to dilute determinism and to emphasise the fact that transformational change can emerge through self-reinforcing positive feedback. Such positive feedback, as represented by causal loops, may lead to tipping points and bifurcations, which are the very essence of a step-change in the nature of the future, whether these are considered positive or negative.

In Fig. 2, we have added such a loop between the driving force labelled 'Stability/instability of interest rates' and that labelled 'Degree of confidence in housing market', since the two will affect each other, potentially leading to positive feedback. For example, a volatile housing market that booms and crashes leads to an instability in interest rates, which in turn affects confidence in the housing market. As in Fig. 2, influence diagrams may include multiple such self-reinforcing or circular causal relationships, some with the potential to cause transformational material change.

5.2. Uncovering the impacts of formal and final causation

Wright et al. (2013) emphasised the importance of placing an enhanced stakeholder analysis at the heart of scenario development methodology, in order to challenge conventional thinking and increase the heterogeneity of the viewpoints discussed. Similarly, Wright and Goodwin (2009) argued for a more intense focus on stakeholder analysis in scenario development, with a particular focus on analysing stakeholders' actions to preserve and enhance their own interests as events in the PESTEL environment unfold by efficient cause (Wright et al., 2013). This new emphasis in scenario development is in accord with our own emphasis on evaluating the effects of final cause. Beinhocker (1997, 2006) noted that traditional economic theory is analogous to Newtonian physics, and is not a valid predictor of behaviour. In contrast, the recent emphasis within economics on behavioural economics focuses on gaining an understanding of human psychology, as does our present focus on understanding final cause. However, our present analysis adds a nuance: the self-interested actions of powerful stakeholders will be affected, i.e., facilitated or restricted, by formal cause, e.g., regulations, legal requirements, institutional structures, organizational missions, etc.

As we have discussed, considerations of the future require the realisation that there are both multiple possible futures and multiple possible paths to each of these. Actions by the powerful may shift the course of events onto an alternative pathway; however, since there are multiple paths to each future, this does not necessarily imply that an undesirable future will be avoided. In addition, analyses of stakeholder motivations and power and structural constraints will reveal the potential for contingent and countervailing cause, which may either enable or countervail any intended goal.

6. Conclusion

The efficacy of the 'standard' IL approach to scenario planning has recently been questioned in the scenario-planning literature. This paper has added to the debate by identifying an additional deficiency in the standard development approach, namely that its inherent practice-based determinism leads to a perspective-narrowing effect. Scenario planning purports to be a technique which denies the possibility of prediction, instead offering alternative ways of thinking about the future based on plausibility. However, IL does in fact focus on prediction, but only within individual scenarios. This 'mechanical' basis, as evidenced by IL's emphasis on uncovering 'driving forces', results in an over-emphasis on one type of cause, known as efficient cause, leading to deterministic scenarios that are based on precipitative cause-and-effect pathways into the future.

This paper has highlighted the dangers of over-emphasising efficient cause in scenario development. These include the misimpression that *each* possible future has a *single* set of antecedent causes, leading in turn to a misimpression as to the usefulness of 'weak signals' or 'early warnings', which, as we have discussed, is currently prevalent in the horizon-scanning literature.

In response to these issues and problems with the standard IL approach, we have proposed various augmentations to the standard IL approach which, when employed together, provide for a broader consideration of cause in terms of transformation, structuration, and human motivations, incorporating three additional types of cause: material, formal and final. The suggested augmentations also provide a lens for considering countervailing factors and contingent conditions in which the different types of cause, and causal agents, may act either in conjunction or in opposition to the effects of efficient cause. The latter analysis and the resulting insights are important, since they

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are a central source of perceived indeterminism, resulting in expected causal relationships, as uncovered by a superficial efficient-cause-focussed analysis, failing to play out as expected. Our analysis showed that it is crucial to consider countervailing factors and contingent conditions when constructing scenarios for the future, since this is the only way to enable the participants in scenario development exercises to gain full insights into the causation underpinning unfolding futures.

In terms of expert knowledge elicitation practice, our application of Aristotle's nuanced analysis of cause enables us to both decompose and evaluate the reasons underpinning a particular judgment or prediction; e.g., the probability that next year's level of growth in inner-city housing in Glasgow will be greater than 10% (c.f., Figs. 1 and 2), or the probability that at least one supermarket chain will offer residential mortgages in the coming year, etc (c.f. Wright & Cairns, 2011, p. 49). Recall that the common focus of expert knowledge elicitation methods is on the quantification of experts' single-point-estimates of uncertain quantities, with some experts' judgments potentially being given more weight in the combination. The elicitation and explication of the causal reasoning underpinning the proffered estimates will allow an expert to both consider the reasoning of another expert and, perhaps, defer to it, thus allowing a self-regulated weighting of individuals' opinions and judgments. Future use of this type of enhanced reasoning-appreciation-and-evaluation procedure is supported by the results of the extant research on the use of the Delphi technique for aggregating individual opinions. This study has shown an exchange of the rationales for particular opinions to improve the validity of the Delphi yield; for a discussion of the research on this issue, see Bolger and Wright (2011), and for proposals for linking the Delphi outcome research to the EKE literature, see Bolger and Rowe (2014, 2015).

In workshop-based applications of scenario planning, the informal aggregation of expert opinions will also be enhanced by the elicitation of participants' underpinning "rich" reasoning, before the facilitated convergence of individual opinions into separable scenario storylines. As such, the use of our practical application of Aristotle's nuanced decomposition of causality will assist those who are participating in expert groups in scrutinising the reasoning underpinning particular anticipations of the future.

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James Derbyshire is a Senior Research Fellow in the Centre for Enterprise and Economic Development Research, Middlesex University, UK. He has considerable experience in carrying out forecasting and planning research for governments and business. He worked for four years as a Senior Economist at the forecasting firm Cambridge Econometrics, and has also worked for RAND Corporation, the European Commission and Capgemini Consulting.

George Wright is a Professor at Strathclyde Business School, UK, and Associate Fellow at Warwick University, UK. He has published numerous papers on forecasting, decision-making, scenario planning and the use of expert judgement. He is co-author of the book 'Scenario Thinking: Practical Approaches to the Future', and an editor of the *International Journal of Forecasting*.

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