

Article

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From compliance to co-production: Emergent forms of agency in Sustainable Wine Production in New Zealand

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journals.sagepub.com/home/epn**Christopher J Rosin**

Lincoln University, New Zealand

Katharine A Legun, Hugh Campbell and Marion Sautier

University of Otago, New Zealand

Abstract

This article engages with non-human agency through the interrogation of the emerging role of metrics in the governance of sustainability in the New Zealand primary sector. In it, we argue that the agency of the metrics builds on previous work that has elaborated the impact of audited best practice on the subjectivities of producers and processors, including the recent examination of the active influence of metrics that engenders unexpected and uncontrolled change in social networks of production. In this case, the analysis of the influence of metrics shifts to those used within a recently introduced ‘learning’ tool (Wine Industry Sustainability Engine) that can be classified as an effort in transition management. The capacity of metrics as agents is already apparent in the perceived interactions and engagements with the Wine Industry Sustainability Engine tool as expressed by likely users during assessments of the usability of initial pilot software. Using their response, we demonstrate that, despite intentions to use the tool to foster particular sets of practices and ethics through benchmarking, the metrics have multiple roles in production worlds—compelling compliance to regulations, creating new ways to communicate complex relations and practices, and generating information for reflexive self-evaluation. Through these roles, we argue, metrics clearly operate as both a material and ontological non-human actor, expressed in different ways in different assemblages. This conclusion has implications for the application of transition management more broadly, and helps us to better understand what we want metrics to accomplish, what they can accomplish, and the possible gap between the two.

Keywords

Sustainability, non-human agency, metrics, wine production, New Zealand, post-human, agriculture, audits

Corresponding author:

Christopher J Rosin, Faculty of Environment, Society and Design, Lincoln University, Lincoln 7698, New Zealand.

Email: christopher.rosin@lincoln.ac.nz

The cumulative impact of human activities on global ecological conditions and processes has not only raised concerns regarding the potential to alter our environment beyond planetary boundaries (Rockström et al., 2009), but also indicated a substantially new era of human–environment relations, the Anthropocene (Crutzen, 2002). While the value and relevance of the concepts of planetary boundaries and the Anthropocene are subject to debate, both are indicative of broader efforts to reframe distinctions between human and environment, culture and nature. In this article, we engage with the growing recognition that attempts to address the ethical component of human–environment relations requires a reframing of inquiry into social practice in order to account for non-human agents (Bennett, 2009; Harraway, 2007; Puig de la Bellacasa, 2010; Whatmore, 2013). In doing so, we remain cognizant that extending the concept of agency beyond humans—or, for that matter, sentient beings—is open to criticism that this distracts attention from the power differentials that define relative capacities to act (for a recent summary, see Hornborg, 2017). Our intent is, however, to draw on conceptualisations of non-human agency in order to bridge the nature-culture divide and more firmly root humans, and their power, in the ecologies that they inhabit. In other words, we seek to understand human power as a composite involving the collaboration of non-human actors. Following Puig de la Bellacasa’s (2010) interrogation of the ethos of the permaculture movement, we argue that the de-centring of human agency is an essential factor in the realisation of sustainable environmental management and in emerging efforts to facilitate sustainable transitions.

The practice of sustainability auditing—seen predominantly as the product of human intentionality—fits less comfortably into a post- or more-than-human framing. Prior work on this topic—including that of the authors of this article—has commonly situated auditing comfortably within the wider framework of neoliberalisation. As a result, it prioritises the capacities of more empowered actors to use technologies of audit to constrain and control producers and thereby achieve economic advantage (for a fuller discussion of this theoretical prehistory, see Campbell et al., 2012; Rosin and Campbell, 2012; Rosin et al., 2017). Inherent to our de-centring of human agency in this article, we deliberately temper this focus on neoliberalisation, to create openings for the possibilities that lie behind and around the ‘constrain and control’ framing. Some of this work has already been initiated through the utilisation of an assemblage approach to acknowledge diverse agencies in interrogating practice-centred and relational relationships in the New Zealand wine economy (Le Heron et al., 2013). Similarly, we seek to better account for the fact that the networks formed around such governance practices are assembled from diverse actors, both human and non-human. In fact, some of the most powerful actors in these assemblages are the metrics used to assess compliance and measure progress. The capacity for practices of monitoring and diagnosis to create and shape social practices and relations has been documented, for example, in the assessment of atherosclerosis (Mol, 2002), in differentiating qualities of meat (Henry, 2017) and in defining the attractiveness of apples (Legun, 2015a, 2016). More specifically in relation to sustainable transitions, the active role of metrics has been recognised in terms of their potential to initiate and drive change in practices and mindsets (Alrøe et al., 2017). Here, we engage more directly with the agency of metrics in efforts to promote sustainable practice in the New Zealand wine sector by examining the relationships they create with the humans who are implementing or using a new form of iterative and interactive sustainability auditing. Taking a post-human approach allows us to better assess the dynamic role of metrics in their relationships with human actors.

While existing literature describes how metrics shape a given world of action—medical diagnosis, meat packing, apple sorting—this paper focuses more intently on how metrics simultaneously but distinctly participate in a variety of relationships. By attending to the

particular character of metrics as post-human actors, we can expose the multi-layered effects of measurements in these practical spaces—as vehicles of governance, as technologies facilitating the translation and communication of subjective information, and as an ideological project precipitating a reorientation of engagement with the environment. Each of these functionalities of metrics operate at the same time, and provide insights into the challenge of designing metrics for the specific purpose of transition management without concurrently generating an agent of compliance or a language for (market) communication. These functionalities have as much to do with the environments they enter as their intended objective design.

In developing this analysis, we will first discuss the theoretical context in which ‘things’ such as the measures and criteria used in sustainability assessments are attributed agency. This discussion culminates with Bennett’s (2009) elaboration of a political ecology in which responsibility for outcomes or events may lie outside the realm of human action or intentionality. We then briefly review pertinent aspects of the literature on sustainability transitions and their relevance to the New Zealand case study. In particular, we focus on the critique of the purported neutrality of managing such transitions, including the additional factor of the agency of the metrics themselves. This is followed by an introduction to the context of sustainability auditing in the New Zealand wine sector as well as the methods used to gather feedback from its users. Using qualitative analytical methods, we examine their expectations regarding the impacts on their practice associated with a newly introduced tool (the Wine Industry Sustainability Engine, WiSE) with real time benchmarking capacities intended to manage sustainable transitions. We conclude by raising the need for an awareness of and sensitivity to the metrics themselves and their likely impact on the practices of not only the users of this tool, but on those of its owners and designers as well.

Theoretical context: The agency of metrics

The emergence of quality designations verified by audit schemes and supported by arrays of measures in high-value agri-food chains has been fertile ground for the understanding of sustainability as a social practice. From the mid-1990s, agri-exporters and retailers, along with a range of other interested parties, have elaborated complex worlds of compliance, inhabited with new grades, standards, protocols, metrics and benchmarks that underwrite risk management and claims of enhanced product quality in high-value markets (Busch and Bain, 2004). For much of the international trade in products invoking sustainability or environmental claims, practices of audit have become the default mechanism through which the production, authentication and marketing of products are organised (Campbell, 2009, 2013). While these worlds of compliance are ostensibly developed to reward producers who use improved agricultural management practices through market access and price premiums, the neutrality and benefit of their implementation is subject to debate. In particular, given the potential for uneven accrual of the economic benefits, the introduction of audit schemes raises questions regarding the allocation of responsibility for the outcomes—social and environmental as well as economic—associated with compliance. They are also, explicitly, technologies of *governance* which are traditionally associated with questions about how these constrain and control the autonomy of producers.

Given the implications of auditing for the ordering of relations of exchange in value-chains dominated by conspicuous power differentials among human participants, academic analysis commonly addressed it as a feature of neoliberalisation. Within our work in the New Zealand context, however, the exclusive focus on power failed to account for the ascendancy of auditing in producer subjectivities or, more relevant to our argument here,

for the unexpected and uncontrolled re-organisation of the networks of production. Our objective is, thus, to extend critical analysis of the governance of sustainability in agri-food chains to consider how metrics participate in the creation of 'sustainability subjects'. We propose that, while their participation resonates with earlier findings, metrics simultaneously engage in other forms of work that reflect their position in multiple sets (and scales) of relationships.

The character of metrics and their vibrant effects are particularly relevant for understanding new forms of market-driven agri-food governance in the context of audited best practice in the New Zealand horticulture sector. Much of the prior work in this area focuses on the perspectives and subjectivities of producers in relation to sustainable practice. The findings demonstrate how what starts as a frustrating exercise in documentation and paperwork for the producers has often induced greater awareness of the relevance of management decisions for achieving desired environmental and social outcomes. Drawing on the concept of subjectivities, it is further possible to identify emergent approaches to sustainable management across types of producers in the sector. Perhaps more surprising is the extent to which such changes extend beyond individual behaviour and 'disciplining' and initiate unexpected changes in the collective identity of producers and in the social networks of production (Rosin, 2008). This latter observation underlies an interrogation of the capacity of metrics (on which the audits rely) to elicit action and coordinate change in production networks, investing them with distinct forms of agency (see Rosin et al., 2017). That is, where the audit criteria are largely comprised of the practices of individual land managers, the practice of compliance contributes to the reorganisation of the social and environmental relations that orient production networks. Here, we argue that metrics operating at a regulatory level may, at a more localized scale and in a different set of relationships, act as a common object of collective insight, precipitating more reflexive practice.

Our use of agency in this manner draws first on Actor-Network Theory, which broadens the definition of agency from one requiring intentionality to one which emphasises the capacity to maintain sets of relations with other elements of an actor network, and contribute to otherwise unrealised action. The cohesiveness of such a network is a product of the ability of any node (either human or non-human) to become indispensable to the continuity of the network, thus enrolling the other participants. While non-human participants may not exhibit the intentionality of human actions, they perform essential roles in determining how that intentionality plays out (Latour, 2005). Moreover, they influence what types of action are considered possible or plausible, thereby shaping the formation of intentions. Notable examples of non-human agency are presented by Callon (1984), who demonstrates the capacity of scallops to direct the attempts of scientists to insert themselves as experts in fishing conservation projects; de Laet and Mol (2000) who provide a detailed analysis of the characteristics of a specific technology (the Zimbabwe Bush Pump) to enable its adoption; Legun (2015a, 2015b) who describes how apple trees have shaped apple markets; and Dwiartama and Rosin (2014) who show the active role of rice in the culture and politics of Indonesia. Law and Urry (2004) situate economic metrics like GDP as highly influential in negatively shaping worlds and ontologically constraining outcomes and there have been signs of pragmatic attempts to reconstitute the metrics and measures of sustainability and wellbeing to enable new possibilities (e.g. Carolan, 2012). Each of these examples draws attention to the character and nature of specific non-human actors that exert power in terms of enabling or inhibiting the ability of humans to achieve desired outcomes.

Here, our argument relies on a further extension of the definition of agency that invokes the concept of assemblages as the object of attention. Assemblages, in this case, involve

relationships between elements that operate in a comparatively fluid manner, disassembling and reassembling without concern for detrimental effects to a given temporal configuration (Lewis et al., 2013). In this context, Bennett (2009) poses the political question of how to apportion responsibility for the events and outcomes of assemblages, especially where these have negative impacts. She further suggests that the significant role that material objects play in human–environment interactions demands a revised conceptualisation of political ecology, one that acknowledges the power wielded by such objects. In her analysis, the failure of the power grid across a large swath of North America (including the northeast USA and southeast Canada) in 2003 is a prime example of the substantial culpability of the grid’s materiality. This culpability contradicts attempts to allocate responsibility for failure to the actions of any individual human agent. Moreover, it implies a distributed view of power, where the outcome is more shaped by relationships than the qualities of any one material. Applied to the case study of the WiSE tool in the New Zealand wine industry, this logic challenges expectations that human agents can sufficiently manage the sustainability transitions they seek to initiate. Instead, our analysis directs attention to the ways in which the possible actions of the tool can only be understood by considering how it performs in the collaborative assemblages it enters.

Metrics not only enter a network of social relations and behave in unforeseeable ways, but the shape of their functioning is also dependent on how people recognize their legitimacy and existence. All non-humans, no matter their form or type, share this characteristic of being practically tied to their recognition: they are phenomenologically present through the acknowledgement of their effects. It is for this reason that pragmatist philosophers refuse to distinguish between the existence of an object, the recognition of its existence, and its practical effects (Harman, 2002, 2011; see also Heidegger, 1996; Peirce and Turrisi, 1997). Under this approach, “things” and how they are defined are irrevocably tied to what they are seen to do; and what they are seen to do is a product of how they interact with other things (see, Bryant, 2011; Callon, 1984; Law, 2009). This basic structure underlies actor-network theory and the claim that objects are defined by their performance (which is, in turn, shaped by the networks in which they are placed).

To claim that objects are contingent on their surroundings is not to say that non-humans such as metrics are a direct product of the unique social worlds around them—on the contrary, they enter into social lives and people interact with them as shared features of reality. Moreover, they are not wholly subjective or boundless in their perceivable properties, but have some stable features that are recognizable across human actors. Nobody is confusing a measure of sustainable water use with a recipe for shortcake, and we can recognize that they would enable very different actions in similar networks. And yet, like all non-humans among us, metrics have “numerous qualities that can be turned to reveal different surfaces and uses” (Harman, 2011: 7). For metrics, those surfaces and uses hinge on the intersection of matter and meaning, and are evident in the different ways that people talk about what metrics *are* and what they *do*. Looking at metrics in this way provides an indicator of how they operate in broader human and non-human networks, and also how a single object can be seen to support a variety of independent networks through material and ideological support.

Metrics can be seen as an attempt to shift what is visible (and invisible) in the world by emphasising particular traits or elements of social practice and simultaneously obscuring the relevance of others. The use of colour in apple grades, for example, creates a quality hierarchy based on a particular aesthetic, and allows that aesthetic to be a basis for exchange between sellers and retailers. Location of production, cultivation practices, or even flavour become invisible in the producer–retailer relationship (Legun, 2016).

Sustainability metrics, moreover, perform this work with an ecological purpose. This shift in visibility has both practical and ideological sides, and relational/networked outcomes. The crafting or designing of metrics by sustainability managers is, thus, both a recognition of these performative aspects of metrics as well as an attempt to shape them in a way that more easily participates in the desired relational ends. In other words, metrics do not only represent the world symbolically, but also craft human and non-human relationships. We can see this in the ways that metrics precipitate human–nature interactions oriented to disciplining and governance, representation and communication, and reflexive introspection. The co-existence of the multiple sides to these objects attests to their material autonomy, while also establishing an explanation for how a specified, let alone optimal, outcome is beyond the power of those creating sustainability audit schemes.

In this article, we examine how the agency of metrics contributes to attempts under transition management frameworks—as compared to more routinised certification systems—to engender more reflexive and relational approaches to sustainable practice. We further elaborate the ways in which the WiSE tool becomes functional within several assembled worlds, altering what it does in each space, and limiting the ability to isolate it for a transition management purpose. We illustrate this distinction by examining the case study of the New Zealand wine sector, which has undertaken a concerted effort to adopt a more proactive approach to sustainability. The sector already has an established certification scheme under the Sustainable Winemaking New Zealand (SWNZ) label. Building on the success of this scheme (which has 94% participation among winegrowers and wineries), the sector is now implementing an enhanced assessment and reporting tool with the expectation that this will facilitate the transition to improved practice. In building this argument, we contribute to conceptualisations of the agency of non-human actors by elaborating the specific character of metrics, while describing how non-humans are participating in different networks concurrently.

Sustainable transition management

To this point, we have focused on the argument that measures, as material objects, assume multiple forms and functions in sustainability assessment and in human/non-human networks more broadly. The relevance of our case study to this argument relies on the distinction made in the sustainability literature between the routine of auditing for compliance and the expectation of a more iterative engagement with measures through the WiSE tool. We characterise this distinction as that between targeted sustainability policies and transition management, the latter attempting to harness the benefits of more lively, non-human participants. Transition management is about mobilizing dynamic metrics, such as benchmarks, collectively and iteratively developed but autonomous from any one individual. In this section, we provide a short introduction to transition management, representing it as a new exercise in precipitating sustainable practice through the participation of lively metrics.

The emergence of the concept of transition management as a form of governance is traced to a shift in approaches to the promotion of sustainable practice in the Netherlands (Kemp and Loorbach, 2003; Rotmans et al., 2001). Its roots lie in the growing recognition that regulating individual practices (e.g. recycling) was leading to compliance with the specific regulation or use of a specific technology without the adoption of the broader awareness or practice of sustainability. In academic literature, the approach was elaborated through the application of the concept of regimes of practice (from Foucauldian governmentality) as an explanatory frame for the stubborn persistence of practices with outcomes that were

contrary to sustainability goals (Berkhout, 2002; Geels, 2010). The focus, thus, began to change to a more systemic engagement with the sets of technologies and associated practices that would require transitions as society was exposed to better options that challenged the perceived appropriateness of common practice.

The shift to transition management involved the attempt to incorporate the insights from the analysis of regimes of practice into environmental policy. The first, and still most prominent, example of this shift was undertaken in the Netherlands where transition management was instituted as part of the country's 30-year policy plan in 2001 (Kemp and Loorbach, 2003). In this case, the objective for government was to further incentivise existing technologies and practices that were oriented toward more sustainable futures and to set a broad target of 'sustainability' that was not confined to a single behaviour (Kemp et al., 2007). A similar policy prescription was proposed for sustainable development efforts, transferring the model to social as well as environmental objectives and to other cultural contexts (Kemp et al., 2005; Loorbach, 2007). The growing scholarly interest in the concept has also extended to agri-food specific contexts (Hargreaves et al., 2013; Hinrichs, 2014) examining its suitability to understanding the dynamics of alternative food systems.

Despite addressing many of the concerns associated with the overly narrow focus—in terms of both temporal and practice scales—of earlier policy efforts, transition management (as a project of governance) has also been subject to critique. In particular, Shove and Walker (2007) argued for a more cautious and critically aware implementation of the concept based on four absences in descriptions of its application: a seeming lack of awareness of political economic implications of such policy; the lack of proven management techniques for promoting desired transitions; the unacknowledged bias toward existing practice with the potential to miss novel options; and a failure to deal with broader issues of practice, including its embeddedness within everyday and customary practices often indirectly related to sustainability. Rather than suggesting a wholesale abandonment of transition management, these cautionary issues raise the need for a more critical application in policy. In doing so, the authors reinforce the importance of viewing transitions as complex social activities as opposed to being a more straight-forward response to technological innovation. Much as is the case for the focus on neoliberalisation in agri-food research, Shove and Walker's critical perspective does not acknowledge the lively, relational actions of metrics or the practices and subjectivities they inspire.

The literature discussing the implementation of transition management is well established and continues to address the types of social complexity raised by Shove and Walker. In this article, it is not our intent to make a decisive intervention to the debate regarding the merits of transition management as a form of governance full-stop. Rather, in the spirit of Shove and Walker's intervention, we suggest a further overlooked factor in (some forms of) transition management, namely the role of metrics or measures as vibrant actors—with a variety of different practical capacities—in the networks developing around such management efforts. While metrics can be invested with human intentionality, the effects of those metrics are shaped by their incorporation within a broader network of practice. As a result, transition management can be seen as an attempt to more expertly craft a sense of collective ownership over the metrics and in doing so, a more introspective, reflexive relationship to the symbolic world they propose. Control over how metrics will participate in practice is, however, limited. And, once those metrics are created, they are agentic and autonomous. Any failures or apparent missteps along that pathway are not necessarily due to mismanagement—or, for that matter, to the social dynamics raised by Shove and Walker; these may, we contend, be the result of the participation and agency of metrics and their multiple forms in a given management scheme.

Case study and methods

The New Zealand wine sector provides an informative opportunity to interrogate the role of metrics in transition management and associated networks of production. Wine produced in New Zealand is predominantly destined for export markets and, by targeting quality over quantity, has maintained one of the highest average prices per bottle in the world. This generates considerable value, but also demands active management of quality to maintain high levels of value-creation. As an emergent New World producer, the early development of the sector was defined by the experimentation and innovation of independent and relatively small winemakers and growers. A more recent dynamic of the sector, however, is the tension among large international corporate investors, New Zealand's home-grown corporates and the large number of individuals who have established smaller wineries in prestige varieties like Pinot Noir. In a recent analyses of the sector, Overton and Murray (2014) find evidence of concentration in wine production in New Zealand as well as the dominance of a single variety (sauvignon blanc). These dynamics have significant impact on the conduct of social and economic relations within the sector (Hayward and Lewis, 2008). Trade publications report on the five largest wine companies (Grapegrower and Winemaker, 2017), with Constellation Brands (the largest by volume) accounting for 12 per cent of annual harvest in 2017. This economic configuration poses significant questions for the social practice of wine production in New Zealand—particularly around the extent of democratisation of decision-making in attempts to control the volume and to maintain high value through centralised institutions (for a fuller discussion of participation and democratisation in the sector, see Sautier et al., 2015).

At one level, the sector demonstrates tendencies indicative of the neoliberalisation approaches common to agri-food research. The introduction of the SWNZ audit was predicated on the desire to create a standardised branding with 'sustainability' qualities that would satisfy the demands of high-value retailers and consumers in international markets. During the period since its introduction, however, summaries of the sector note a consistent number of small wineries and winegrowers despite the concentration at the larger end (Lee-Jones, 2017). An assessment of the sector based solely on production indicators also fails to acknowledge the collaborative nature underlying the development of the SWNZ audit (Sautier et al., 2015). While we agree that the proposed new tool, with its benchmarking features and industry-wide data aggregation, has the potential to be more malleable to the actions of powerful sectoral players, there are additional roles that the metrics play in the wine networks. Our claim is not that the latter eclipse the regulatory implications, but that there are additional functionalities afforded through the metrics that are also active in the wine assemblage and that coexist with dynamics of power.

While not specifically designed as such, the WiSE tool can be framed in terms of transition management. The tool was introduced in 2015 and is constructed on existing engagements with sustainable practice, both in the compliance with SWNZ auditing and in the experimentation and experience of individual winegrowers and winemakers (Sautier et al., 2015). In addition to simply collating available data, it has incorporated benchmarking capabilities in order to promote learning by users who are able to identify better practice among their peers. This latter potential is also desirable to industry participants who are looking for a more efficient means to raise the performance of suppliers across environmental and social as well as production criteria. It is this latter aspect that shifts the tool from one of sustainability assessment to transition management. Rather than merely setting the criteria for 'acceptable' and sustainable practice, the tool is expected to create a learning environment in which incentives for improvement are provided through exposure and heightened attention to system factors. While it is too early to determine the extent to

which such changes have been realised, in the interest of our argument regarding the agency of the metrics we can draw on the participants' expectations regarding the potential influence of the new reporting capabilities on themselves and the sector.

The imminent implementation of the WiSE tool provided the opportunity to engage with users who had been introduced to a pilot version. Using a semi-structured interview including a set of mostly directed questions on software usability followed by a group of open-ended questions regarding expectations for the use and application of the tool, we were able to identify the distinct character and action of the metrics under the transition management framework. The interviews were conducted with 27 winegrowers and winemakers that were selected by SWNZ as more likely to actually 'test' the early version. This selection process may have biased the sample toward those users more likely to embrace the wider potential of the tool; but it includes a variety of users in terms of size of operation and role in the winemaking process (i.e. contract growers, growers, winemakers, winery managers, winery owners). In the following analysis, the quotes are assigned to numbered participants in three wine producing regions (Central Otago, Hawkes Bay and Marlborough).

The agency of metrics and emergence of transition management

For the designers and owners of the WiSE tool, the influence of the metrics is perceived as a means through which to achieve controlled management of a transition to more sustainable practice. Given the existing success of SWNZ certification, it was assumed that the metrics would maintain, and ideally enhance, sector wide governance of practice and, thus, reinforce coherence despite the diverse interests and objectives of its human participants. Explicit to the proposal submitted to receive government funding for its development was the further intention to produce a tool that, in promoting iterative learning, exceeded the functionality of a simple organisational database. The expectation was that an assessment and reporting tool could guide users toward best practice, with objectives 'ratcheting up' through competition and the introduction of additional criteria subject to the demands of markets and scientific insight. In this manner, metrics would make new aspects of management practice visible and shift attention away from factors less relevant to the representation of sustainability promoted by SWNZ. The actions of metrics are subject to the context of New Zealand wine production, allowing the sector to move toward new, locally relevant definitions of—and at the same time, understandings and identities associated with—sustainability. The legitimacy of the metrics' action is, moreover, reinforced by their capacity to articulate relevant aspects of sustainability within a framework of internationally recognised criteria and indicators, and to translate these across sectoral, cultural, societal and disciplinary boundaries. Such outcomes are of particular interest to the owners of the WiSE program who perceive a need to maintain market credibility for their claims to sustainable practice as consumer demands evolve and incorporate new representations of social and environmental wellbeing.

The intended users of the WiSE program see a similar array of dimensions to their expectations of the actions associated with and impelled by the tools' metrics. It is possible to categorise these as those related to governance and involving WiSE as nothing more than a compliance tool, those making new elements of practice visible to assist management practice, and those initiating new understanding of sustainability as an agent for positive change. These three forms imply a range of 'work' and types of action being achieved by metrics, although there is also a clear differentiation among users who focus on the human intentionality behind the implementation of the tool from those who more fully embrace the potential change in either a more passive reaction through best practice across

the sector or through experimental engagement with the tool. The first form is expressed by participants who are less willing to yield agency to the introduced metrology, seeking to maintain a greater level of control over emerging subjectivities of good winegrowing and winemaking. They also demonstrate greater sensitivity to the power dynamics of compliance. The other forms are evident in the response of those who, while not overtly referring to the agency of the metrics, indicate the context within which these non-human participants are expected to contribute to emergent networks of sustainable practice in the wine sector.

While it is impossible to gauge the actual role and impact of the WiSE metrics at this early stage of implementation, their potential agency is evident in the expectations ascribed to them by the tool's designers, owners and users. The narratives that describe the adoption of WiSE attest to the ways that human actors in the sector envision the incorporation of the metrics into the productive world of winemaking. Below we describe different expectations of the WiSE tool depending on what it is perceived to do in a given social and material assemblage of actors. In the context of governance, the metrics are seen as static and docile, and calling for compliance. In international marketing contexts, the metrics are seen to provide the language through which environmental practice can be defined, translated and communicated. Lastly, the metrics provide the platform for self-governance through benchmarking, and under this network, provide a lens through which practitioners can reassess the sustainability landscape and their place within it. While the latter is most closely aligned with transition management, it is useful to acknowledge that all three roles emerged in response to the deployment of a transition management tool.

Enacting governance

The most commonly recognised form of agency attributed to the WiSE metrics was related to their potential to facilitate governance within the sector. It is a capacity that was as likely to be considered 'threatening' as 'beneficial', depending on the extent to which the actions of the metrics resonated with the goals and expectations of the individual user. Whereas many users referred to the metrics as being implemented by SWNZ, they all located the power for initiating new levels of governance in the actions and capacities of the metrics. The metrics, in a sense, were seen to compel compliance and organize growers regardless of their own personal identification with the designation that would be granted to them. Thus, the tool creates sustainable subjects by introducing a vector through which wine producers collectively become subjects of sustainability as a ruling institution.

In this context, the metrics become an affront to the ability to maintain control of emergent practice, and the WiSE tool is an unwanted infringement on management activities associated with participation in SWNZ certification. This attitude reflects a similar perspective on the prior audit compliance scheme that was considered a necessary evil rather than a means to realise best practice, let alone sustainability, in the sector or in their operation. This position takes the form of resistance to the perceived intentions of the owners, SWNZ, who are pushing the boundaries of acceptable interference in the autonomous practices of winegrowing and winemaking:

They [SWNZ] are trying to turn it into a management tool. [The growers] are not going to use it. This is compliance—they have to do it. So they want to get in, they want to do it and they want to get out. If it produces a pretty graph at the end, then that's all good. (M2)

This response suggests that, despite the attempts by practitioners to switch onto a more self-reflexive engine under ideas of sustainable transitions, the metrics will still be understood as acting in a traditional form of audit compliance. Within a broader governance network,

the tool continues to play a role of positioning producers and their practices, and enlisting producers into a project involuntarily.

In addition to the challenges of establishing environmental and social goals for good practice through the ‘external’ intervention of SWNZ, the inability to promote broader sustainable practice is attributed to the prevailing autonomy of winegrowers, especially for those who are growing under contract for wineries.

We’ve [the wine sector as a whole] got something to prove—that we’ve got that clean green image. . . We’ve worked hard to get to where we are and our customers don’t know it. And the growers—unfortunately, they’re not involved in that side of marketing. So there needs to be a benefit for them. At the moment, it’s just a compliance exercise and they all hate it. . . (M13)

In this context, the WiSE tool is a policing mechanism with the potential to build a collective identity around best practice that can be exploited as a marketable quality.

[I] see the value of making it a common tool for the industry. You know, if you’re all doing the same thing, giving information about the industry, across everything – quite quick and easy. . . Could become a great unifying tool for the whole industry. . . (M10)

Despite this latent resistance to enrolment by metrics, most of those interviewed had positive expectations for the tool similar to those associated with the previous audit. Moreover, they imply that the impact of the tool predominantly lies in the intentionality of either SWNZ, which is seeking to discipline practice in the sector, or larger winemakers, who are seeking greater control over contract growers. Within this context, the metrics potentially reproduce the types of subjugating force that, while equally applied, unequally affect wine producers. In other words, the use of WiSE as a compliance mechanism has the potential to privilege the best resourced, and the most equipped to influence its development and craft it to their advantage. We do not dispute that this may be occurring in wine, and the characterizing of the metric as a “compliance exercise” “that they all hate” with the option to “unify the whole industry” would be consistent with this role of the metric. We do, however, want to emphasise that these kinds of social outcomes remain partly dependent on the active role of the metrics themselves in redirecting production and management objectives toward the outcomes they privilege. In this case, WiSE initiates an intermingling of the power of metrics and the unequal nature of socio-economic outcomes evident elsewhere in New Zealand primary production (Rosin et al., 2017).

Making visible

In some cases, the WiSE metrics were defined through their expected capacity to make unknown elements of practice visible. In a context where human relationships with ecological processes increasingly cause anxiety, social critique, and are in need of validation, the metrics perform a key role as beneficent contributors to the operation of the wine sector. In many ways, metrics in this assemblage perform a traditional role of symbolic scientific documentation that can make highly subjective experiences—production practice—clear, simple and mobile. For example, one manager working for a large winery pointed to the practical advantages of the reporting functions included in the WiSE tool for vindicating his actions:

[It’s a] good tool for us as managers to be able to take to our Board or our CEO and say, ‘Well, look, we really need to make sure we’re compliant, we need the resources to be able to do that.’ (M10)

The metrics are expected to empower actors through the enhanced visibility of the practices and outcomes they track. Benchmarking is also considered a means to communicate parameters of best practice beyond the production chain, providing a stronger indication of safe practice to the community as well as marketing value.

This perspective is reinforced by the fact that, for many, the potential to engender positive change in practice is the product of improved access to information and the ability to assess performance relative to standards:

I think we are seeing that change coming... if [WiSE] can drive that, I don't know. I think the biggest thing is, once people can measure and compare what they've done, they can make changes. *If you can't measure accurately then you can't make the change and see the benefit side.* If [WiSE] enables better measurement then people can see that and make changes, so that's probably its biggest help.... (M12, emphasis added)

The metrics enable an improved awareness of individual management practices and their impacts and, thus, create the environment within which change in practice can occur. It is further apparent in the interviews that the enabling of change, while oriented around the reporting of individual practice, is expected to occur across the wine sector.

For some of the users, the exposure to newly visible aspects of their management, especially through the capacity to benchmark relative to peers, allows the metrics to confront them with undeniable and more objective facts:

It's comparing apples with apples. What I do in my vineyards and the reasons I do it are arguably different. And my labour costs for example, are. And we've been benchmarking for a number of years—there's the top end of that... on the more basic things, how much water I'm using, how much energy I'm using. Sure they're simple and they do make sense across the board... Some of the other stuff is pretty subjective; but in the end, if it's looking at you in the face—I guess you've got a number and then you've got to ask yourself what it means so that's another [thing]. (M9)

While still uncertain as to the exact parameters of measurement, there is an expectation that the tool will substantially broaden the elements of practice measured; and, in the process, provide a set of numbers that demand action. The active role of the metrics is also acknowledged in their capacity to do work and to initiate physical change in vineyard management.

If the dashboard can give real time information that I can sit in the office and analyse and then go into the vineyard to investigate, that is what I need. I can go out physically and change it; then I know [WiSE] is working. (HB9)

Such statements demonstrate the capacity of metrics to contribute to a process of improvement in the practice of vineyard and winery management that incorporates the newly visible aspects achieved through reporting and benchmarking data.

Users with similar perspectives of WiSE also begin to recognise the unique potential of the metrics in terms of engendering change beyond the boundaries of the individual vineyard or winery. For example, this participant suggests that the advanced benchmarking capabilities available with the tool will provide a more forceful incentive for change in mindset as well as practice:

I think [there is potential to change mindset]. If you have the information there and, you know, you can see what other people are doing in a more instant form than, sort of, a once yearly report... Yeah, it does encourage you to think. Ordinarily I'm using three litres of fuel per hectare. What am I doing differently? (HB5)

The agency of the WiSE metrics remain, however, subject to the receptivity of the human agents, as metrics are seen to have greater capacity to enrol those already inclined toward sustainable practice:

I don't think [WiSE] will do that 'cause I think it's either in your mind or not in your mind. I mean I think the younger generation coming through is growing up with it, you know. It's already in school, in the environment of those schools and the kids are already learning about recycling being part of life. So it's going to get easier – wanting to manage sustainability because that's all you know; whereas for others it's more a new concept and it's harder to grasp and manage it. So I don't see that this particular project... it's either something that you want to do or don't... I think you've got to be in the right frame of mind in wanting to know if you are sustainable or not.... (M13)

For the most part, these users see the activity of the metrics as mediated through their engagement with and utilization of the newly visible factors in WiSE reporting; yet the metrics remain integral to the process. In other words, WiSE metrics are expected to actively set new parameters for acceptable practice within the sector and provide a means to communicate this achievement in a similar but more authoritative manner to that achieved by more straightforward audit compliance. Once confronted with the visibility and legitimacy of the measures, the participants in the sector will be empowered, or in some cases impelled, to initiate change that supports the sustainability (both as a reportable outcome and as an imaginary) of the New Zealand wine sector. Users position the metrics as a lens through which the world becomes otherwise visible. This also generates a third action associated with metrics: their ability to invite challenges to the ways the productive environment is socially defined and understood.

Initiating ideological reflection

In other cases, the articulations of WiSE metrics proposed that they would enable a shift in ideologies of sustainable practice in the wine sector that was distinct from that achieved through the existing audit scheme. In this respect, users shared some of the expectations held by the owners and designers that more timely benchmarking of practice and performance could encourage a more iterative engagement with the metrics, which would also compel a more temporally expansive and ecologically grounded practice. The metrics in the assemblage, and their continuity across actors and through time, was expected to ground winegrowers and winemakers in their ecosystems in new ways. Users saw the potential for a more dynamic metrology (one that introduced new criteria in response to scientific insight and consumer concerns) to instill a stronger orientation toward sustainable practice in the sector:

Biodiversity is very important in grape growing. While it is a monoculture, we're looking at biodiversity issues in terms of the wider ecosystem. If it's not made a focus, people are not going to take notice. If these things can be measured, benchmarked somehow, it will help with sustainability planning. (HB8)

In this manner, the WiSE metrics have the potential to raise awareness of outcomes that extend beyond the more typical and ephemeral measures of input efficiencies and cost reduction to the realigning of the environmental subjectivities of winegrowing.

Despite noting the unique potential of the new metrics to elicit deeper and more powerful engagement with the concept of sustainable practice, users were sceptical that an assessment tool such as that provided in the WiSE pilot software could meet expectations. In other

words, they were concerned that the packaging of the metrics within the WiSE platform might constrain the work achieved. Thus, these users were also the most likely to offer suggestions for the improvement of WiSE, both as a tool and as a project. Some were critical of the design, which they felt did little to incentivise the type of engagement necessary to realise more radical change:

Would like to see a way to draw me into the questions being asked. At the moment, it is just about filling it out. What's going to make me use it more? There's currently no pull to get me back into it... Maybe two or three voluntary modules on currently relevant information. (CO3)

In this sense, the agency of the metrology is a direct result of its capacity to enrol the user, which, in turn, would enrol the user into a new and more sustainable practice.

In terms of the social determination of sustainability within the sector, some users attributed metrics the capacity to differentiate practice that was homogenised and obscured under the existing certification audit. This was occasionally expressed as a desire to achieve recognition for achieving a level of sustainability beyond the norm that could be demonstrated through the benchmarking capabilities and flexible reporting of the WiSE tool:

Sure, I could see where perhaps you have the main module where this is the reporting that you need to do to get your accreditation and then you can have perhaps another module which takes you the next step up and perhaps you get a merit accreditation. Which might be you have your health and safety plan registered on there, your harvest management plans and standard operating procedures for various bits and pieces, or environmental plans. So you would have your basic compliance and your merit accreditation targeted at absolute best practice. (HB5)

A more sceptical user (he questions whether SWNZ is the appropriate owner for the WiSE tool as he desires stronger support for non-organic practices that meet environmental and social criteria) recognises the potential for the emergent agency of WiSE metrics to facilitate change in the perception of best practice as well as in practice itself within the sector.

Benchmarking is one area that would be of value; but it needs to be done well. It's easy to do benchmarking at a high level, but much more difficult for something of value. We will be swamped by the organic and biodynamic systems if we don't better define best practice. We need to get a conventional system that's on equal footing. (CO4)

Following the logic expressed by these users, a further action of the WiSE metrics involves a shift that enables a move from expressing sustainable behaviour in terms of 'good enough' (that is, simply meeting audit criteria) to 'better than' (on the basis of benchmarking). This flexibility in the absolute meaning attributed to the concept of sustainability further allows for conventional practices to become part of a more systemic ideology of environmental production on par with organic or biodynamic. As anticipated by the designers and owners of the tool, the metrics are seen to have the capacity to inspire a competitive response among at least some users that can spur the pursuit of improved practices. Thus, when metrics are placed in an assemblage of heterogeneous users, embedded in their ecological systems, they can become a collective living artifact of social-ecological effort, and an agent of agitation and change.

Reflecting the potential for ideological change expressed in this section, some of the participants were already demonstrating their desire to interact with the tool and its metrics. This included a small number of users who had attempted to negotiate the limited reporting and benchmarking capabilities of the pilot software. Whereas this

inevitably led to criticism of the limitations and poor ‘usability’ of these features, it also provided fertile ground for proposed future experimentation. For some this included the introduction of more diverse and incisive metrics, like the reference to biodiversity above. For others, it was seen as the foundation for creative means of visualisation and communication of sustainability criteria both within the production process as well as for government regulation and marketing.

Human and non-human agency in the implementation of WiSE

The ways that interviewees responded to the WiSE tool demonstrate that its impact on the sector extends beyond the narrow intentions to coordinate practice along a delineated set of sustainability indicators. Rather than focus solely on the tool’s capacity to enhance the regulatory capacity of SWNZ (or its leading members), the responses reflected diverse understandings of what the tool (and its constituent measures) was actively doing within different assemblages. These interpretations also aligned to the degree of agency individual users thought that they had within the assemblage. The first set of responses reflects an approach in which the agency of the metrics is viewed as primarily the congealed agency of powerful human actors. The metrics in this governance assemblage were seen to impose standards external to the participants, requiring their compliance involuntarily. This assemblage invests metrics with a particular form of agency associated with carrying regulatory power. However, this classic governance role can coexist with other metric actions that are performed in other assemblages.

In the second set of responses, the performance of metrics is located in their translation of ephemeral, embodied practice into a more static, scientific, and auditable symbolic world. This translation of practical life into a language alters what can be said and the mobility of information. Users identified ways that sustainability metrics could be used to justify resource requests from CEOs and winery owners, keep track of practices over time, and communicate to consumers. The metrics, thus, can be seen as a vehicle for human agency; and yet, to think of humans as holding the power would be to obscure the ways that metrics influence what becomes visible and thus valuable. Rather than merely passive symbols, representing what exists in the physical and practical world, metrics are a value system that delineates what—having been made visible—is important and what can slip from our vision. While our study does not have the capacity to identify whether metrics shape the future of practice, we would expect that activities that are marked as having high cultural currency and being easily circulated would be more easily upheld.

The final category points to a further potential for the reflexive character of the measures in WiSE to enable and drive change in the New Zealand wine sector. This will involve a transition in the practices of winegrowing and winemaking, and in which the metrics become participants in a more ideological project. In this assemblage, which involves ecological ties between users and their immediate environment being altered vis-à-vis benchmarking with other local users, the metrics become a type of living collective text. The interview participants suggested that the metrics could entice users into sustainable subjectivities and influence how they thought of their practice. In this manner, the agency of the metrics was seen as participatory and vibrant through its iterative change in response to multiple activities by different humans. The assemblage of the metrics is on-site and functions at a practical level, and yet as a collective algorithmic entity, remains autonomous from individual human guidance. The dynamism of the metrics under these last conditions also has the possibility to generate unforeseeable futures, which some users viewed as generating more radical possibilities.

Each of the response types raises some cautions in terms of the expectations that the owners and designers (as representative of policy makers in transition management more broadly) place on the potential to arrive at sustainable outcomes, including both those identified by Shove and Walker (2007) and those involving the agency of metrics. Throughout the interviews it was apparent that the information to be collected by the WiSE tool was considered both easily exploited through power differentials as well as useful for achieving sustainable practice. Often the metrics were implicated in the increased capacity to police or control the actions of others, from the ‘cowboys’ in the sector whose actions might damage its reputation to suppliers who were less committed to the goals of SWNZ. This aspect of the WiSE program was also evident in the recognition that the information collected could be used by local government regulators, distributors and consumers to exert excessive or unwarranted demands on the users and their practices. These concerns align with the ways that metrics act as agents of subjugation in governance contexts, or the ways that the representation of activities through metrics can generate undesirable visibilities. Not all of the users conformed to the expectation that benchmarking of itself would achieve change, while several noted that issues of communication were not fully resolved. In relation to the mechanisms of management, there were also some questions as to the appropriate role of SWNZ, both as the owner of WiSE and as a regulating agent, going forward.

The interviews also refer to the active role of the WiSE metrics in the emerging practices of winegrowing and winemaking. All of the human participants being enrolled to assemblages involving the WiSE program recognise the potential vibrancy of its metrics at a practical level, a feature that was also evident with the style of audit scheme that revolved around normative suggestions for agricultural ‘best practice’ rather than numerical measures (Campbell et al., 2012; Rosin and Campbell, 2012). For the designers and owners, this agency underlies their interest in the program by providing a new means of facilitating a transition to more sustainable practice and more marketable environmental and social claims. Among the users of the program, enrolment is met with varying levels of acceptance. At one end of the spectrum, users are already rebuffing enrolment by the metrics, classifying the influence of the latter as at best an annoyance and at worst a hindrance to effective management. Others see the potential for an improved baseline for best practice similar to the perspective of the designers and owners. In this case, the emergent agency of the active reporting and benchmarking provides a mechanism for achieving not only best practice in the individual operation, but a vehicle for a shift in thinking and an engaged form of sustainable practice as well. Such an outcome would involve a reflexive reconstruction of the identity of the good winegrower and good winemaker, a shift that would not occur in the same manner without the action of the metrics.

Implications of WiSE for sustainable transitions

At one level, these interviews are preliminary observations of how new metrics can be enveloped into existing practical worlds, changing those worlds and what they do. In this context, our analysis is primarily an examination of the multi-layered behaviour of metrics, rather than a survey of their effectiveness. Yet, we can provide some insight into how the shift to transition management may alter how metrics behave, and we suggest that they may behave in different ways depending on the relations conditioning their enactment. It is too soon to exactly establish the outcomes that will eventuate in terms of on-vineyard or in-winery environmental practice. That said, significant insight to the operation of sustainability assessment tools can be drawn from the WiSE case study. Shove and

Walker's four cautions highlight compelling issues in the unfolding of WiSE that influence our understanding of audit as a mechanism for transition. Perhaps most notably, those being regulated by metrics through forms of audit are not passively positioned in these processes. Concerns that power would be situated with either big institutional actors or with standards-setting agencies that use these technologies of audit to constrain and control practices and outcomes and not with situated producers or socially motivated agents are overstated, while simultaneously obscuring the multi-layered aspects of metrics that perform a variety of functions in different sets of relations. In the WiSE case study, at least three potential behaviours were attributed to the new audit scheme. In one, users were relatively passive and reactive; but the others were associated with more active participants, expecting to use the work of metrics to achieve their own goals, and engage with and shape outcomes. This leads to two broad conclusions: (1) participants in audited practice are not passive recipients of change and (2) they are not frozen in one particular response. They shift and reposition themselves and this would appear to be of major significance in how environmental practices change (thus reinforcing the conclusions of Campbell et al., 2012). A further conclusion, as suggested above, is that there is greater potential for experimentation and innovation than might be expected. This can only be tentatively drawn from research that examines the introduction rather than the maturing of a new system, and thus warrants further examination (see Sautier et al., 2015).

It is also important to note that WiSE metrics participate in these assemblages even as the tool is initially implemented: they are shifting subjectivities, changing expectations by making new worlds visible and creating new ideological spaces. A better understanding of the transition initiated through interactive sustainability assessment is dependent on the continued analysis of emerging conceptions of 'good' practice among winegrowers and winemakers, of expertise in terms of improving practice and of the relevance of the diverse criteria that comprise the tool. Similarly, the impacts of WiSE are likely to be found in altered relations with such actors as regulators, consumers, agronomists, scientists, politicians and local communities. The experiences with audit compliance (Rosin et al., 2017) indicate that it is not a question of if, but when such metrology-initiated change occurs. What is less certain, given the expectations that benchmarking will elicit a new form of engagement with metrics, is how such change will be expressed. A further inevitability is that such unscripted change will also influence the actions and perceptions of the owners and designers of WiSE; or, in Latour's terms, the intentionality of transition management will be directed through the nature and character of the metrology.

Finally, this examination has highlighted the way in which metrics, launched with intention but enacted independently of those purposes, are under-recognised as active agents of change in environmental practice. This is especially the case given the frequent reference to the users' experimental engagement with WiSE. In light of Bennett's (2009) arguments regarding a political ecology that takes serious account of such agency, it is important to incorporate the vibrancy of metrics in future accounting of the success of managed transitions. While the tool may be designed to place producers in the drivers' seat of sustainability transitions, and our research found evidence that some producers recognize that functionality, other roles that metrics may play can also be considered as sources of friction or opportunity. If the metrics are seen to be forces of top-down compliance, how might the broader assemblage be altered to enhance a sense of democratic participation? Or, as several wine producers suggested, how might the interface be designed in such a way that ensures that the process of reporting is a rewarding activity, and rewarding in a way that attends to the degree to which they are

burdensome? How might the self-governance and sustainable ideology interface with new forms of legibility and communicability in the market? While efforts to transition management may inspire the design of new tools and metrics, they are introduced into complex and layered spheres of action. They may be successfully taken up as platforms for information sharing and collaborative generators of environmental momentum, but the work they do in other sets of relationships should not be overlooked. While great gains can be made on the transition front, experiences of governance may shift and the ecological landscape may become legible and communicable in different ways. As participants in multiple fields of practice, the lively force of metrics invites us as researchers to better recognize and respond to the actual futures being crafted, rather than simply evaluating the linear success of sustainable intentions.

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