Data-driven risk-based quality regulation

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Executive summary

In an increasingly diverse higher education system, as found particularly in England, data-driven models of risk-based regulation and quality assessment can support the needs of both providers and users. The Office for Students (OfS), the new regulator, has indicated that greater use of metrics will enable risk assessment through analysis of institutions' 'leading indicators' in a cost-effective and burden-reducing manner, as well as better informing student choices and enhancing competitiveness.

This report considers the application of data-driven risk models in higher education by considering the ways in which they are used by regulatory bodies in other sectors, specifically the Care Quality Commission (CQC), the Food Standards Agency (FSA), the Financial Conduct Authority (FCA), and HM Revenue and Customs (HMRC). The experiences of these agencies suggest lessons for higher education regulation.

The report considers the increased availability of data from a wide range of sources and the ways in which these can be used to better understand and therefore improve the learning experiences and outcomes of students in higher education. The report concludes that data-derived instruments applied within a risk-based assessment system have the potential, particularly when applied in tandem with peer review approaches, to promote organisational learning and resilience within higher education institutions, as well as satisfying needs to ensure the achievement of basic standards in all institutions.

Methodology

The material for this report was gained using the following methods:

1. Extensive analysis of the considerable online documentation and policy analyses, including reviews and assessments posted on websites, for the four case studies.
2. Interviews, sometimes extensive, with staff at the agencies.
3. Expert interviews with academics at the Centre for the Analysis of Risk and Regulation (CARR) at the London School of Economics and Political Science. They had either written about one of more of these agencies, in one case had been employed in a permanent full-time position, and/or had published extensively on data, risk, regulation and indicators more broadly.
4. In-depth interview at the Higher Education Statistics Agency (HESA).
5. Analysis of relevant higher education reports on data, particularly the Wilsdon Report and that by the Higher Education Commission entitled 'From Bricks to Clicks'.

Introduction: key issues

A number of key issues are raised by data-driven models being used more extensively in regulatory and quality bodies, such as:

- Data metrics, and associated algorithms, can distort if not applied carefully; education is a complex activity which places some limitations on the use of such technologies.
- Data and analytics can be useful for decision makers when applied in organisations with good working cultures but less so in others - in the latter, performance indicators tend to be regarded as a stick with which to beat people rather than a helpful guide to achieving better outcomes.
- Behavioural science suggests that data are readily interpreted to fit pre-existing narratives - through anchoring, representation, availability and similar psychological processes - and policy applications need to be aware of such individual 'non-rationalities'.
- Data are used to produce more and more correlations, many of which may be spurious and which require testing for causality - reliable and relevant data are what is required for both users and policy makers.

Current data applications and reports in higher education

a HESA

At present it appears that metrics will have a major regulatory function in the operation of the OfS, and this requires increased attention to data governance.
HESA (Higher Education Statistics Agency) is the higher education data agency, funded by subscriptions and responsible for the delivery of a statutory function.
HESA currently manages six data sets, each renewed annually. These consist of: the student record; graduate destinations record; staff records; finance records; estates records; and off-shore student records. The main users of these data are: Government and funding bodies; Official Statistics; higher education institutions; and prospective students (UniStats).

The imposition of a single data model on an expanding and increasingly diverse sector poses many challenges, not least in language and meaning - such as 'what is a course?' 'What is a full-time student?'

As the Teaching Excellence Framework (TEF) moves to including a subject-level assessment of institutions, then data mixes and variable cultures, plus any attempts to 'play the data game', may undermine the data and processes they are intended to measure.
The TEF, however, explicitly combines both metrics and peer review.

b Wilsdon

The Wilsdon Report (HEFCE 2015) highlights a set of broader issues in applying metrics to higher education. A key matter is the extent to which data help *enhance* existing peer-review assessments by allowing essentially qualitative judgements to be aided and supplemented by quantitative evidence; or, whether there is scope for data to *replace* at least some peer-driven methodologies, thus reducing costs and other resources' burdens on both institutions and assessors. In the health sector, the Care Quality Commission (CQC), for example, regards its extensive and increasingly sophisticated digital data collection on providers as underpinning its reliance on expert-led regular inspections of all health services providers. On the other hand, the OfS, in recent consultations (DfE October 2017),

has stressed that regular and cyclical expert assessment by way of institutional visits should be abandoned in favour of a more data-driven approach in which targeted reviews of institutions may follow selectively as a result of 'flagging' of risk generated by 'lead data indicators'.

Perhaps not surprisingly, the Wilsdon review found considerable scepticism among researchers, universities, representative bodies and learned societies about the broader use of metrics in research management. Peer review, despite its flaws, continues to command widespread support as the primary basis for evaluating research outputs, proposals and individuals.

Yet the report also found that a significant minority are enthusiastic about greater use of metrics, provided appropriate care is taken. Sector sentiment may currently be summarised as preferring a 'variable geometry' of expert judgement, quantitative indicators, and qualitative measures that respect differing disciplinary and institutional cultures (and which, to a large extent, the TEF is seeking to reflect).

Nonetheless, whether data are used to supplement or reduce expert judgements in quality assessments, Wilsdon argues, inter alia, for a) *robustness*, basing metrics on the best possible data in terms of accuracy and scope; b) *transparency*, keeping data collection and analyses open so that those being evaluated can test and verify the results; and c) *diversity,* using a range of indicators to reflect and support a plurality of approaches across the system.

c The Higher Education Commission (HEC 2016)

This report focuses on how the increased availability of data in institutions could be used to improve the student experience (including learning and teaching), and distinguishes between 'static data' and 'fluid data'. *Static data* are that which are collected, recorded, and stored by institutions and traditionally include student records, and staff, financial, and estates data. *Fluid data* are the data that are generated through the increasingly digital way a student interacts with their university, such as swipe card data from access-controlled campus buildings, log-ins to the virtual environment, and e-books or online journal downloads.

Data-driven quality assessment is likely increasingly to focus on institutions' fluid data and associated management systems, which has the potential to provide an instant, accurate picture of how a student is performing. However, it must be able to be collected, linked, and analysed. These processes form 'learning analytics', which the HEC defines as 'the measurement, collection, analysis and reporting of data about learners for the purposes of understanding and optimising learning and the environment in which it occurs' (p.4). This allows the institution to provide targeted and personalised support to each student. However, student data analysed in this way is not especially useful unless integrated and compared with the learning and related designs and objectives of teachers.

Although there is evidence of some institutions being well advanced, 'learning analytics is still in its relative infancy in the UK'. Yet there are strong motivations for both institutions and external quality assurers to promote learning analytics, including: increased retention; providing better feedback to students; capturing attendance data; and enhancing teaching and learning.

Regulators

The following sections examine three regulators in sectors other than higher education to consider how data-driven methods are developing and how they may possibly be applied in higher education. It also refers to data work in the Government's Operational Research Unit across departments, particularly HMRC where the availability of large data sets considerably facilitates risk analyses. In a number of such bodies there is increasing use of behavioural science in aiding purely data approaches, or at least in interpreting them, to assess estimated levels of compliance. The OfS, too, is committed to utilising such theories. However, the experience of these and other regulators is whether measuring (and reacting positively towards) 'responsiveness' by those being regulated to regulatory requirements when challenged is the same as measuring actual levels of risk in a sector.

The three sectors and four regulators examined here are healthcare (a 'public' services sector that is seen as broadly comparable to higher education in funding, scrutiny and internal governance) and the Care Quality Commission (CQC); financial services, where new regulatory bodies, such as the Financial Conduct Authority (FCA), are beginning to introduce stronger approaches to data collection and management as part of better engagement with the organisations it regulates; and the Food Standards Agency (FSA), which has an explicit commitment to the application of data science in its regulatory approach to the handling and preparation of food. Additionally, we look at a broader 'non-sector' regulator - HMRC.

Care Quality Commission (CQC)

The CQC's purpose is to make sure that health and social care services provide people with safe, effective, compassionate, high-quality care, and to encourage care services to improve. Currently, CQC's reports and ratings allow it to differentiate between providers and services that are outstanding, good, requires improvement, or inadequate. With its first inspection programme of an integrated health and social care provision complete (2016), reports and ratings show a large variation in the quality of services. Essentially, the CQC is inspection-led and, rather than relying on market competition, seeks regulatory means to drive improvement.

The methodology used by the CQC is new and involves the use of qualitative and quantitative data sources. These include: analysis of CQC ratings given to providers; self-completion surveys (taken at different points in time) of providers, people who use the provider services, and the general public; CQC's internal management information; and case studies of 27 providers' experience of being regulated by CQC, which is qualitative research conducted by an independent research organisation. However, the time periods covered by each type of data are not consistent.

The key function for the CQC is regular inspection of providers by those expert enough to make informed judgements. Monitoring and data collection is undertaken to help inform the inspection process rather than to replace it in part or whole. As a risk-based regulator, CQC collects and analyses a wide range of data from different sources, which helps to inform the CQC when and where to inspect, as well as to guide what to look at when it inspects. The information includes national data, provider information returns, safeguarding alerts, statutory notifications, feedback from local partners, and whistleblowing.

In helping to monitor NHS trusts, CQC has developed 'CQC Insight', 'which brings together in one place the information we hold about your services…this helps us to decide what, where, and when to inspect and provide analysis to support the evidence in our inspection reports'. CQC Insight analyses information from a range of sources to monitor performance

across all types of NHS trust and produces monitoring reports which 'enable us to have an ongoing conversation about quality'.

For all NHS trusts, CQC Insight gives inspectors:

- Facts and figures.
- A ratings overview.
- An intelligence overview.
- Performance and monitoring indicators, showing, for example, a trust's performance compared with national standards or with other providers; or indicate changes in a trust's performance over time. All indicators are mapped to CQC's five key questions.
- Featured data sources: for example, the findings from national surveys, incident reports, mortality ratios and outliers.

CQC Insight currently focuses on existing data collections, and shortly will become a fully digital interactive service. This will help it to maintain real-time data and provide more regular interaction with providers. Additionally, however, CQC employs 'relationship owners', whose responsibility it is to maintain regular but often informal contact with a group of providers and to gather more qualitative forms of risk information. CQC regards precise anticipation of risk events as problematic and sees data-driven risk indications as a signal to further examine a provider.

Social media and risk regulation

Additionally, not just the improved collection of data, but data analytics based on social media models, may have a much larger role in the future quality regulation of the health sector. A study by Griffiths and Leaver into the online world around healthcare explores ways in which data may be better used to identify good and bad care (LSE/CARR 2017). They sought to discover whether 'patient voice', captured by the vast amount of disparate feedback posted online about their hospital experiences, could help regulators to prioritise and target their regulatory interventions. They found that it could.

Griffiths and Leaver collected over the course of a year more than 1.5 million tweets, Facebook posts, and comments posted on dedicated patient feedback websites directly concerning NHS hospitals and the trusts that they comprise. By automatically identifying, classifying, and scoring relevant information on a universal scale, and then combining those pieces of information, they were able to form a 'collective judgement' as expressed by patients for each hospital on any given date. They found a strong, statistically significant relationship between the collective judgement drawn from online on the start date of inspections by the CQC, and the ratings awarded by the CQC at the end of those inspections. This is true for both individual NHS hospitals and the larger 'trust' groupings to which they belong.

Financial Conduct Authority (FCA)

The FCA, which engages in all aspects of financial services, has set out a 'Data Strategy' in which it explains why 'data is important to us as a new regulator' (p.2). How does it intend to use data to strengthen the quality of its risk-based approach? Initially by clearing away the 'legacy' of its predecessor, the Financial Services Authority (FSA), among which failings were:

- too many requests for data and information without a clear explanation about why it was needed
- unreasonable timescales, resulting in firms needing to divert resources to meet regulatory requests
- failure to communicate what the data and information were used for, leaving firms questioning whether it was used at all
- lacking appropriate internal governance to identify all the requests made of firms to ensure the appropriateness of requests, consistency of communication, and the re-use of data and information already gathered
- lacking the necessary technology to fully exploit data and information throughout the lifecycle of collection, storage and use.

The FCA regards data and information as 'a key enabler to our success, supporting our drive to be a forward-looking risk regulator that operates efficiently'. It identifies three types of data that it needs:

1 Core baseline: this data contains all the regularly reported data on which the FCA bases its regulatory activity. It is the core data that must be reported regardless of any other data requirement and should form the foundation for activity conducted by the FCA. Examples of core baseline data include the returns submitted by firms through the GABRIEL reporting system, product sales information, and complaints information.

2 The second type is called Risk and Event and supplements the core baseline. This is where risks are identified that form one of the FCA's strategic priorities, or where events occur that require data in addition to that held in core baseline. Such data would typically only be required for a period of time while the risk is mitigated or the event managed.

3 The third type is called Subject, Firm or Issue Specific and comprises one-off data specific to a subject, firm or issue that the FCA is acting on, but which may be re-used in future (for example, data collected as part of an Enforcement investigation or through FCA's authorisations activity).

The FCA regards its data strategy as helping a better engagement with firms and earlier identification of risk factors. That is, inspections alone will increasingly not be the only or primary means for regulatory examination of risk factors. Moreover, as with other risk-based regulators, data will be used to determine the incidence and approach for inspecting firms based on evaluation of risks identified by initial data analysis.

A key development by the FCA, much like that in the higher education sector, is the creation of an Information Governance Board. This governs the requests that the FCA makes for data and information more than once and/or from more than one source, ensuring that large-scale requests are appropriate and proportionate, with clarity of purpose and a clear engagement plan with those supplying the data. Only those data requests that passed review by the Governance Information Board were submitted to firms.

A joint data management committee with the Prudential Regulatory Authority (a sister financial services agency) oversees data sharing arrangements and seeks to ensure that dual-regulated firms do not receive duplicate data requests. Additionally, the regular publication of a new Data Bulletin seeks to increase the usability and transparency of some of the FCA data, bringing together the data published, providing readers with information about how the data are used, and making it easier to locate. The FCA intends to develop the Bulletin over the next few years.

The FCA is also testing new technology, including, for example, trialling a new cataloguing tool to centrally record details of the data and information held, as well as engaging with data

suppliers and software companies to test available and emerging technologies. A key objective is to deliver a core set of technology to support data management capabilities, including the FCA's master data, collection and analytics. Big data analysis underpins econometrics while behavioural economics helps to guide designs to the consumer market and to determine how choices are put to its participants to provide more transparency and informed demand. The recent OfS consultation (A. 95) refers to the example, drawn from retail insurance services, of the FCA disclosing the premium that consumers had paid the previous year. This proved the most effective way of prompting consumers to shop around and switch or negotiate their home insurance policy to achieve substantial savings.

The FCA also undertakes thematic reviews as part of its monitoring, providing an additional and forward-looking perspective on providers and also facilitating cross-sector collaboration. Generally, these comprise office reviews of data and visits to regulated organisations.

Food Standards Agency (FSA)

The Food Standards Agency is part of a governance system implemented by local authority environmental health officers. Although the FSA was created at central government level following a series of food crises in the late 1980s/early 1990s, the better to protect consumers and their health, local authority enforcement has remained largely untouched. A great deal of emphasis is placed on consumers and on being transparent, with considerable effort put into consumer surveys and providing accessible information to help consumers make informed decisions.

The food industry, like higher education, is one of the largest and most important industries in the world, and is a sector containing very different business organisations. A complex 'food ecosystem' generates an enormous amount of data, such as information about consumer purchase histories, allergy and nutrition information, and data from premise inspections including food hygiene inspections. Nonetheless, large investment in digitalising its databases enables the FSA to publish its hygiene ratings of food establishments within two weeks of inspections. Its 'open data' policy ensures that anyone, including other regulators, is able to access its data in a timely fashion.

The FSA inspects and audits the environmental health departments of local authorities. It has authority to set performance standards, monitor performance, demand information from local authorities, and inspect their food enforcement resources. In the interests of transparency any reports they compile as a result of their audits can be made public.

The FSA is aware of those indicators that alert it to the possibility of higher risk, such as meat and oyster products, or late-night opening. Inspections remain a critical evaluation tool, not least as internal control systems are regarded as key risk indicators. Moreover, the FSA operates a system of informal contacts with local authorities through relationship groupings with key regulatory staff.

The Food Standards Agency (FSA) has plans for more regular monitoring of establishments through the application of new technologies and the data they generate that may in time reduce regulatory dependence of inspections as normally undertaken by local authorities on behalf of the FSA. 'End of pipe' activity (as also in emissions monitoring) appears to allow for such a possibility, although it is not yet clear how applicable to higher education such an approach might be.

The FSA's Chief Scientific Adviser (currently Professor Guy Poppy) reports that while 'data science is being used across all areas of government, its use is being increasingly realised within the regulation of food safety. From using sensors to check the temperature of the food we eat, to using big data techniques to help us build a better picture of the hygiene practices

of food businesses, data science is essential in enabling the FSA to ensure the food you eat is safe to eat' (2016).

The Chief Scientific Adviser's Report (Issue six) also shows how the FSA is bringing together a range of data - such as on economic conditions, social media, and consumer preferences - to help the FSA meet its statutory obligations. For example, its award-winning work on predicting norovirus outbreaks through tweets, and the analysis of health claims regarding raw milk on YouTube, are two such examples. Using analysis of tweets, the FSA gains around three weeks against a system of laboratory sampling when issuing warnings of the imminent spread of infections.

Professor Poppy notes that in the constantly evolving field of big data science, 'developing partnerships with both producers and users of data is essential'. These include collaborative research with University College London's Big Data Institute, the Office for National Statistics, and the Government Digital Service. The FSA believes that one area that can greatly benefit from the use of data science is surveillance. Its latest Science Report demonstrates how big data feeds into the implementation of a new and innovative surveillance strategy.

In its view, the value of data is most readily realised high in the 'data pyramid' (knowledge and impact) and by making its data open, and also through effective use of others' data through a collaborative approach. Nonetheless, it is important that the right data are included in addition to a good breadth of data. Ideally, this data already exists as collecting data is often expensive and time consuming. However, it is important, too, to avoid simply using existing data because 'it is there' when it has been collected for quite other purposes and may not be suitable as an indicator for this new objective.

Generally, however, data analysis extracts information from data collected and adds context; expert advice and engagement with others provides knowledge and insight from this information. These insights are then used to direct action, which in turn leads to impact - including the protection of consumers. 'Data science approaches allow us - more than ever before - to make smarter use of data to create this impact' (2016, p.2). However, the FSA is becoming increasingly interested in behavioural impacts on data in other fields as part of policy design. It regards such developments as 'social norm' communications ('the percentage of people like you who wash their hands before preparing food') and similar to influencing the FSA's policy 'choice architectures' and communications.

Technology

An example of what is described as 'A data-driven Food Standards Agency' is the use of new cost-effective technology (e.g. sensors) to continuously and automatically monitor food temperatures, where food safety inspections can only provide a snapshot of an establishment's condition and compliance at a single point in time. 'Clearly', the FSA observes, 'the data generated through these technologies provide much greater insight than what could have been obtained through inspection and audits'. This allows close to real-time monitoring, which in turn allows the FSA to act immediately if necessary.

Although supporting inspections of food establishments remains a key purpose of data collection by the FSA it feels that its 'risk rules engine', incorporating increasingly real-time information and driving sophisticated algorithms, may allow a reduction in the length and type of inspections in time. Nonetheless, inspections and hygiene ratings remain 'retrospective' evaluations and are not regarded as necessarily accurate predictions of risk crystallisation. Yet they remain a guide as to the distribution of regulatory resources.

HM Revenue and Customs (HMRC)

Although not a 'sector' as such, HMRC - the UK's tax, payments and customs authority - employs Operational Researchers (OR) who are part of the Government Operational Research Services (GORS) which supports policy making, strategy and operations in 25 government departments and agencies. As HMRC oversees the tax affairs of all UK taxpayers, it has plenty of data for analysts to explore.

There is a variety of OR applied in HMRC, with one classic technique being Predictive Analytics. OR analysts have been targeting the non-compliant - those not paying the right amount of tax at the right time - for many years. Taxpayer interventions provide outcomes that enable use of credit-scoring type techniques to rank taxpayers according to risk (of non-compliance), using sophisticated logistic and linear regression scorecards.

These and similar techniques are being used to predict those taxpayers who are likely to be non-compliant, including those who need help. Where a taxpayer is having difficulties and gets into debt, HMRC's data analysis can provide information as to whether they are likely to sort matters out relatively soon. Consequently, more appropriate action can be taken, assessing risk accordingly.

Similarly, HMRC is able to predict quite accurately who is likely to get into a substantial amount of debt over a long period of time, even if they are not currently in debt. This aids operational staff to direct sufficient resources towards long-term debtors. The large data sets held by HMRC increasingly enable it to forecast the occurrence of debt with high reliability. The use of decision trees and scorecards enables prediction of risk for each individual, meaning different strategies can be used depending on estimations of low or very high risk.

Finally, HMRC models are now being used to predict those who are likely to miss key tax return submission deadlines, then give a gentle nudge in the right direction, thus preventing them from adding further work that could be avoided. This approach has led to a reduction in debt and an increase in on-time filing.

Conclusions and issues raised

Published data and indicators have the potential to provide greater transparency in processes of risk regulation and quality assessment. However, they also possess the possibilities of obscuring accountability through an overly technical and hidden-away expert technology. Openness through such devices as Data Bulletins and Information Governance bodies may help to overcome doubts about complexity and secretiveness in how data are deployed in risk-based assessment systems.

In higher education, a key aim will be to explore how organisational learning and resilience, not just controls, are assisted by more data-derived instruments. In turn, openness and transparency will help in the exploration of how we may reconcile peer and data approaches for a wider sector benefit.

Data-driven quality or 'lead' indicators of risk that we found in the case studies often comprise what may be described as 'mashed-up' compilations of different data sources. That is, they allow considerable choice to the progenitors in deciding which particular indicators to choose, the levels of weightings, and the methods to mitigate double-counting or to overcome data unavailability. Indicators of quality that have been formed in this way normally may be readily transformed into numerical data. Consequently, it becomes even more important that quality regulators are transparent and accountable about their internal assumptions, decisions and processes. Otherwise, quality indicators 'can conceal nuances and restrict contestation by displacing subjective decision-making with the appearance of

hard data' (Fisher 2012, p.217). The case studies show that seeking to achieve more data-driven regulation raises important policy questions.

- What are the data governance requirements necessary for establishing a sound and acceptable basis for more data-driven quality assessment?
- Do such approaches enhance regulatory effectiveness, for example in constructing risk profiles of regulated organisations?
- To what extent does an accelerated use of data and associated indicators reduce regulatory costs?
- Is the aim to enhance peer and inspectorial methods rather than to seek to reduce their roles?
- Do data-driven quality assessment approaches increase transparency, broader understanding and accountability, in comparison, at least, with more 'insider' peer and essentially opaque inspectorial modalities?
- In regulatory regimes characterised by co-regulation and encouragement of self-regulation, do the information and data requirements differ between sector (regulator) and institutional (regulated, self-regulated) levels?
- How much reliance should be placed on data-driven 'lead indicators' (OfS) as a precursor to any regulatory intervention, in comparison with other forms of intelligence?

Hutter (2017, p.105) begins to indicate certain precepts that enable satisfactory answers to such issues. She argues that, from a 'risk regulation perspective', excellent regulators are those that appreciate both the limitations of their own and institutional data and the political context in which they operate. They need to be able to critically appraise the value and validity of available data sources; this requires the necessity to employ staff with the technical skills to use risk-based tools and the ability to interpret and act in response to the data. 'In short, excellent regulators require good data as well as analytical rigour and sound judgement to understand the restrictions of the approach and the levels of (un)certainty under which they operate. Achieving the ideals of risk-based regulation demands the resources to fund these levels of information collation, analysis and interpretation'.

For risk-based regulators interested in applying the knowledge and tools emerging in data science, as is the Food Standards Agency, predictive analytics - which is an analytical technique that uses data to predict trends and patterns that will occur in the future - is regarded as potentially paying huge dividends. Increasingly, data are being collected and analysed from social media sites and are found to be remarkably aligned - and often better - than more conventional regulatory methods. Nonetheless, processes of extraction, classification and analysis provide formidable methodological challenges - while algorithms predicting trends are always confronted with the permanent dynamics of human behaviour, such as uncertainty, change, and free choice. 'Experts', not just machines, are always needed in risk-based regulation and its judgements.

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Acknowledgements

We are extremely grateful to staff at the regulatory and other agencies for agreeing to interviews and the provision of additional useful information. Sian Thomas (FSA) and Hamish Young (CQC) were particularly helpful, as was Andy Youell at HESA, and Alex Griffiths at the LSE CARR.

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December 2017

QAA2074 - Feb 18

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