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## New working paradigms in research laboratories

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Work in research laboratories, especially within centralised functions in larger organisations, is changing fast. With easier access to external providers and Contract Research Organisations, and a focus on budgets and benchmarking, scientific expertise has to be complemented with operational excellence. New concepts, globally shared projects and restricted resources highlight the constraints of traditional operating models working from Monday to Friday and nine to five. Whilst many of our scientists welcome this new challenge, organisations have to enable and foster a more business-like mindset. Organisational structures, remuneration, as well as systems in finance need to be adapted to build operations that are best-in-class rather than merely minimising negative impacts of current organisational structures.

### Introduction

The organisational structure in most big pharmaceutical companies has, despite different acronyms and departmental names, many similarities driven by the shared task, discovering and developing new drugs, and the external environment, pressure from regulators, the public and financial analysts. Many organisations group work and projects by disease or therapeutic area, sometimes supplemented with a focus on target class, for example, GPCRs, kinases and proteases [1–4]. Projects are run vertically from idea to First in Human and beyond, but where support in the past would have been included in this vertical line, with each project responsible for its own work, projects are now supported horizontally, across the whole project portfolio, by platform lines. These are typically formed to bundle highly specific expertise or to generate economies of scale where tasks are capital

intensive and often locally or even globally centralised (Fig. 1).

With a focus on the overall portfolio, these support functions have to balance projects, portfolios and generating discipline expertise and knowledge. In driving operational excellence, support functions frequently develop some of the elements of a production or service-orientated approach and advance outside our traditional definition of scientific research. Importantly, many of these internal groups are in direct competition with external providers and Contract Research Organisations (CROs), yet they are bound by the restraints associated with being part of the parent company. Focusing on the example of *in vitro* screening supporting lead optimisation, we will discuss changing attitudes and work organisation. We will highlight current restrictions and discuss what changes are needed in the future to build first class support,

delivering competitive advantage whilst providing a cost-effective service to the overall organisation.

### Matching capacity and demand

Demand for *in vitro* screening has increased steadily over the past ten years, both with respect to overall screening and also, when normalised with respect to the output of the process. From 1995 to 2006 there has been a ca. 15-fold increase in *in vitro* screening activity per candidate molecule destined for further development and First in Human dosing [5]. New pressures have been added as capital budgets have been restricted, timelines have become more demanding and the complexity of projects has increased by the generation of selectivity and ADME data in parallel and the integration of external collaborators into work streams (providing chemistry support or additional screening

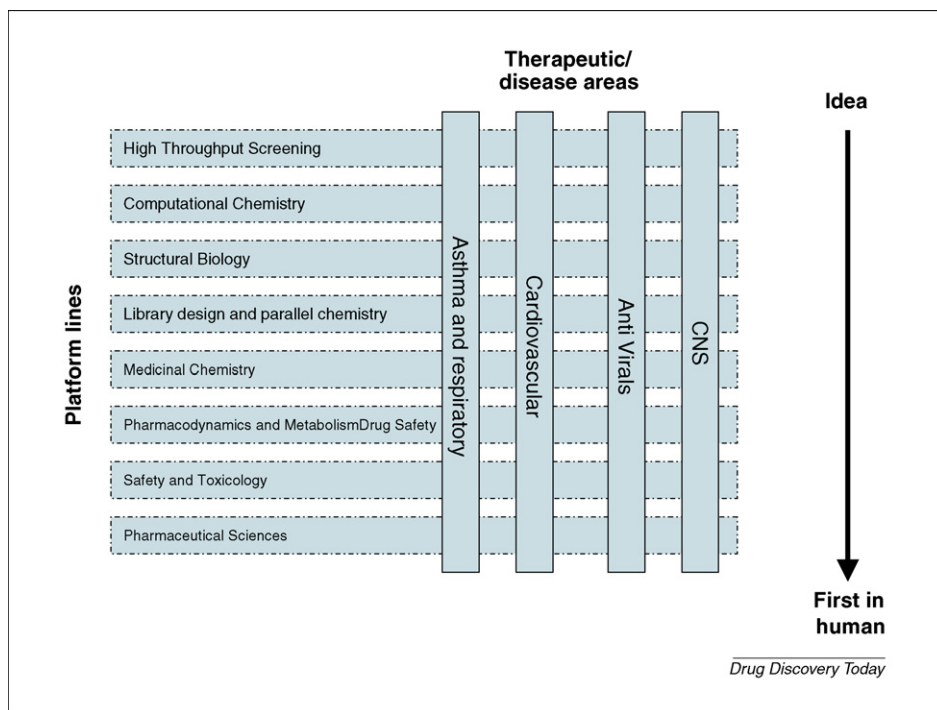


FIGURE 1

Supporting project execution through platform lines. In many pharmaceutical companies certain activities (e.g. high-throughput screening, Pharmacodynamics and Metabolism (PDM) and Structural Biology) are combined in centralised departments. Whilst specifics of this structure vary between companies, they all follow the same logic. The so-called platform lines enable an 'economy of scale' by bringing together a crucial mass of highly specific scientific knowledge and, owing to higher utilisation, make investments into costly equipment more economical. Meanwhile therapeutic areas are centred around building disease-specific knowledge. For project execution project teams are formed to execute the project from idea to First in Human and beyond. The membership of these matrix teams changes depending on the project stage.

data) [6]. To increase productivity further we have to analyse the established practices and workflows in our laboratories. Currently lab space and equipment is generally idle for most of the time, that is outside core working hours from nine to five and over the weekend. Additionally, within the working week and the working day there are cyclical work patterns restricting further productivity gain without additional investment (Fig. 2). We have traditionally tried to resource work to match peak demand, but the restrictions outlined above now require that we make better use of off-peak time and look at ways of extending the working day, through the application of new working paradigms including work in shifts and at weekends.

### New working time models

As a response to these observations we have set up a team working across an extended day, in two overlapping shifts, 6 a.m. to 2 p.m. and 1 p.m. to 9 p.m., alternating this pattern on a weekly cycle. Setting up a new team provided the opportunity to create a 'model' team with a strong work ethic and the ability to act as a testing ground for new processes which, if

successful, could be migrated to other teams in the department. A new recruit would normally have the expectation of close supervision and help over initial weeks and months from existing members of the team. Setting up an entirely new team – one which would be working often at times without longer serving colleagues present, we had to select recruits likely to reach independence much more rapidly, but at the same time rethinking the training strategy. As preparation, we undertook a major review of all of our procedures, standardising and simplifying wherever possible, creating up-to-date and simple to use documentation for all assays and associated screening processes to render the learning curve less steep, the task more realistic and likely to succeed. A combination of standardised training material and work alongside experienced colleagues has been applied to train new colleagues for four weeks before moving to the shift system in two teams of three colleagues. The success of the approach is demonstrated by the fact that the failure rate within the team has been, from the beginning, comparable with established teams.

As the benefits of the new paradigm became established we have moved further teams/

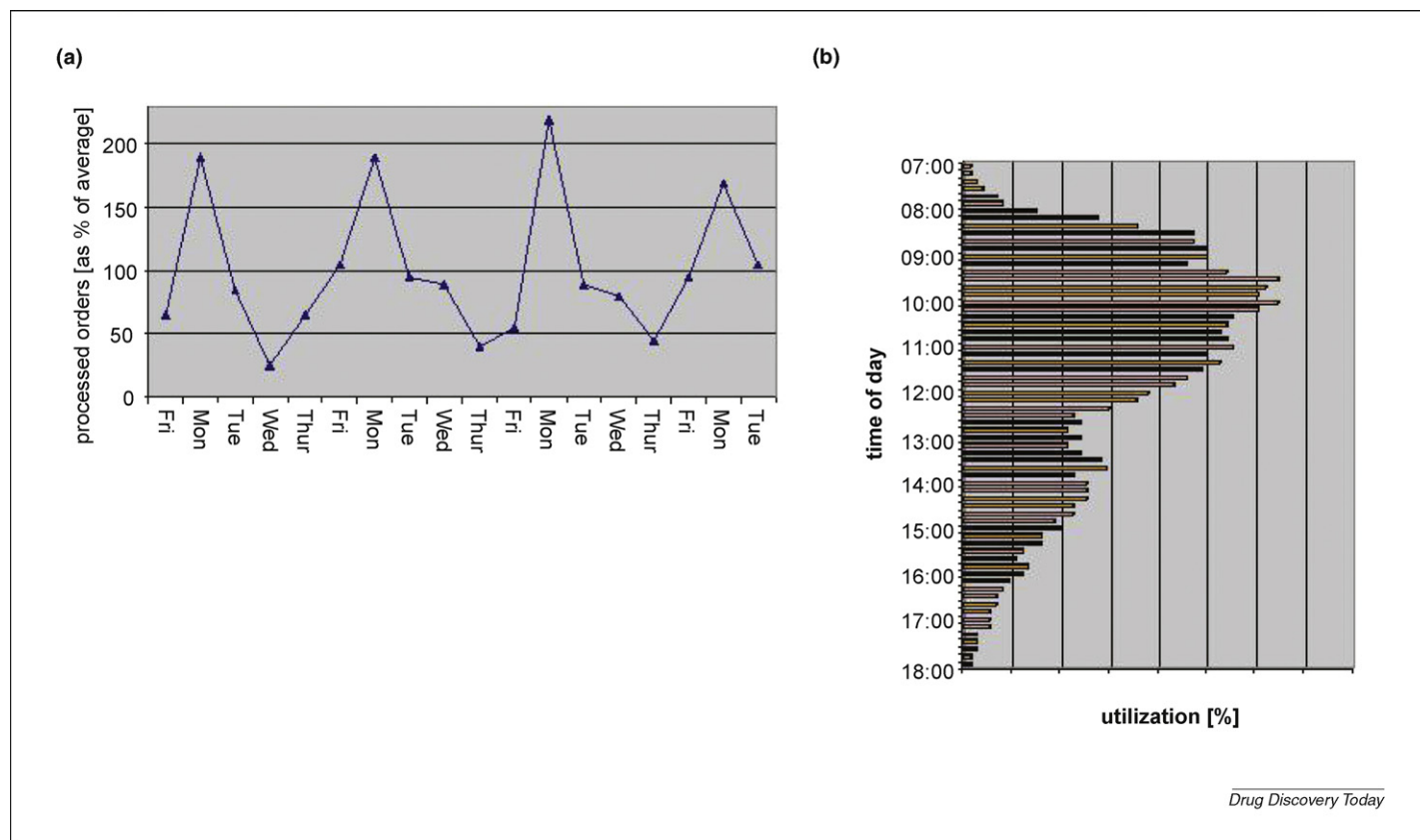
functions into the same shift system. Remuneration for shift work has been increased compared to the standard rate of pay and for the generation of timely and high quality support we have introduced incentive schemes with quarterly payments as an additional tool to focus on performance. Looking at productivity of the 'experimental' team compared to established teams we were encouraged to note that productivity per person was considerably enhanced (Fig. 3). We ascribe this to several factors:

- a longer day in which to start and complete work, leading to more batches of work being undertaken
- unhindered access to equipment out of normal working hours
- ability to focus without the distraction of meetings (which are still centred on normal working hours)
- hand picking of the staff
- new processes which were trialled in the team

By piloting new ideas in this receptive 'model' team, they have been able, quickly, to learn from their mistakes but, more importantly, our conventional teams have had the chance to learn from these mistakes too. Longer into the experiment we have seen the other 'normal hours' teams begin to partly close the productivity gap, underlining that a proportion of the gain is transferable, that is not because of factors only available to the shift pattern, but easier to pilot in that environment. Following the same principles we have extended work into the weekend, initially on a voluntary basis, gaining valuable machine time and capacity and reducing peak demands observed on Mondays within our material management team.

### Finding the right skills and motivation

For operational excellence, platform lines and support functions need to develop and cherish a production and service mentality. We have, however, to find the right staff and, as an organisation, recognise the value added otherwise motivation will be low [7]. Within research, ideas of shift or weekend working have previously been rejected owing to an anticipation that 'no one will want to do this' and their 'incompatibility' with individual creativity and science. This has not been our experience and we have been encouraged by the clear demand for the chance to work overtime hours and weekends. Further, there is a real need for the opportunity to gain practical experience by recently qualified scientists that can be met by the offer of more standardised laboratory work as an entrée into the practical laboratory, preparing them for more stretching and creative

**FIGURE 2**

Cyclical workflow in research laboratories. **(a)** Weekly cycle of order processing in a Material Management lab. Order processing (an order constitutes the request for compounds from the local repository for processing and delivery to the screening scientist) in a Material Management team has been analysed by recording the number of orders processed per day and depicted for each day as percentage of the average number of orders processed per day across the entire measurement period. **(b)** Utilisation of liquid handling equipment within a screening lab during a normal working day. The utilisation of automated handling equipment was measured over a period of eight weeks, following the introduction of an 'equipment booking system' and a detailed analysis of the machine log files. The graph shows the utilisation (average for the timeslot across the whole measurement period) against the time of the working day.

work at a later stage. Whilst we firmly believe that all science can be creative, it is clear that not everyone appreciates the challenge of conducting more routine work to the highest possible standard and it is important to select people who have high capacity for the routine without losing important attention to detail, and who get their buzz from a job well done, for this type of work.

### Redesigning jobs and tasks

Motivation is a powerful driver of human performance. Whilst remuneration is seen as an important component in driving high performance (as measured by the number of performance-related pay schemes in the industry) it is not the only one and is not, as underlined by much research into the subject, for example [8,9], the key driver for many scientists who have additional interests, for example skill development, curiosity, sense of worth. We have to design tasks that, through a clearly defined product or recognised value, provide intrinsic motivation [10]. There is a clear link to the

patient for scientists working directly within the project space within therapeutic areas, but it is more difficult to derive motivation out of this for colleagues in scientific and non-scientific platform lines far removed from this dimension. The segmentation of the overall process into separate steps has further eroded intrinsic motivation and task significance in the context of the overall drug discovery process and this is illustrated by our own experience. Initially, we developed a plan to divide work into specific tasks, providing easier and faster training to new colleagues in a department where focus on capacity and throughput left little room for lengthy training. Thus, team members focused on either screening, reagent production or sample logistics. Within these disciplines, for example sample logistics, this was taken further, with scientists specialising in individual aspects of the whole task. This specialisation and focus is effective in reducing training time and in efficient handling of large numbers of compounds, but reduced the interest level of the work and, in practical terms, whilst large-scale work was greatly

enabled, small-scale processing of samples took longer than it should. The key concepts that have driven efficiency, centralisation and specialisation, are now restricting further process in productivity and quality. In response we have adapted new working models that are compatible with, and are based on, the previous work to standardise processes and establish best practice (i.e. we cannot do the second step before the first), following the principles of horizontal and vertical job enrichment [11,12]: swimlaning (where a compound order is processed from start to finish by one team member) and hybrid roles (screening scientists process their own compounds 'just in time', i.e. compounds are not ordered well in advance from the Material Management team but the screening scientists manage this task as required at the assay start). The model widens the role of individuals, providing greater job satisfaction. Tasks are redesigned with a recognisable 'product' as output, increasing ownership and link to the customer in the projects. Quality is enhanced as problems are acknowledged and addressed

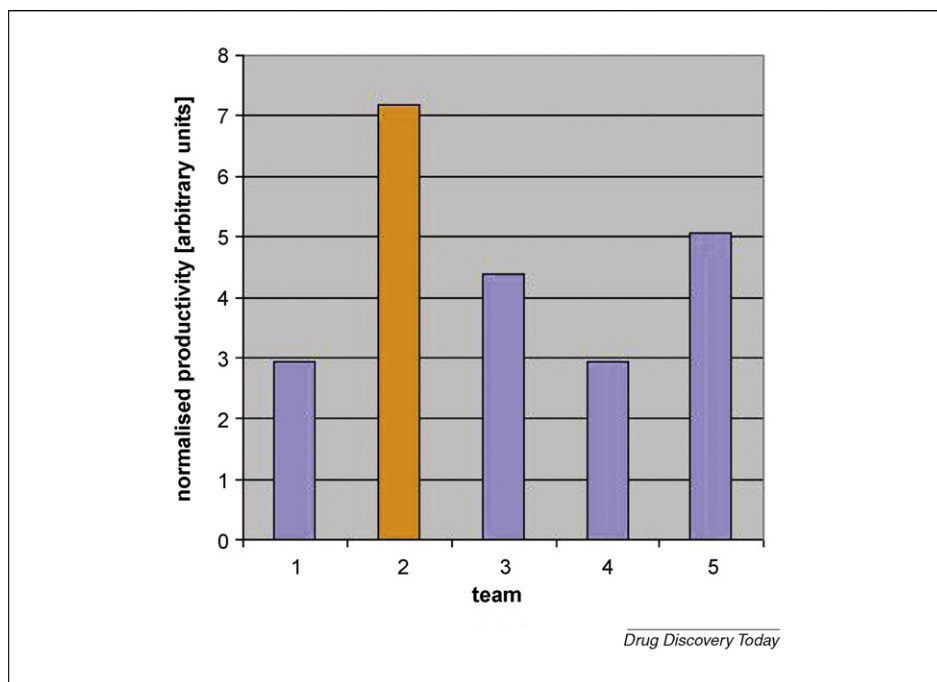


FIGURE 3

Team productivity. To assess the potential benefit of shift work, the productivity per FTE was calculated, comparing teams running assays of similar duration and complexity. The output, as measured by the number of endpoints or plates processed and the cycle time from compound order to data generation, was normalised by the number of FTEs in each team and expressed as arbitrary units. The shift working team is highlighted in orange.

earlier, whilst waiting times are reduced owing to the absence of handovers. We have complemented this by setting up small semi-autonomous work cells that divest more decision-making to the colleagues within the laboratory. This move to autonomy for the teams, and the individuals, necessitates a change in the attitude to risk of management and a greater willingness to trust and to delegate decision-making.

It is clear, however, that for a well-trained team, decision taking by those most close to the work affords a speed and flexibility to changing situations that is difficult to match in a more 'controlling' organisation [13,14].

### Performance measurement and evaluation

To continuously improve operations we have to think about how to assess performance in platform lines. Whilst support roles do not deliver value without a link to a project, we cannot drive performance by having measures far downstream from the platform function. Shared goals aim to integrate and align all organisational parts, but they can be demotivating if perceived outside the influence of colleagues. Ultimately, in the example of *in vitro* screening, we are neither designing compounds nor are we making decisions as to which projects to pursue. The number of candidates for further development cannot be the only measure for

success but, instead, the number of projects brought to conclusion (progressed or terminated) through unequivocal data from the agreed assays, or the lead time for implementing a technology or assay are both useful measures. A process performance index has been suggested to evaluate the internal productivity of *in vitro* screening operations supporting lead optimisation, taking into account the number of assays, FTE resource and cycle time for data generation [7].

Recognising the importance of a service and customer focus (and for continuous improvement) we have introduced some operational measures (e.g. on-time delivery, overall cycle time, lead time and cost); we have used feedback from customers in the Therapeutic Areas to understand what they value most, but then we also need to initiate external benchmarking to establish the performance of the function and to decide on a 'make or buy strategy' [4]. There is a clear need to measure the outcome from the organisational perspective and we should empower teams to find the 'right' way to deliver, focusing on the impact that autonomy has on motivation [11,12].

### Working across team and organisational boundaries

The adapted organisational structures have a profound impact on work within projects and

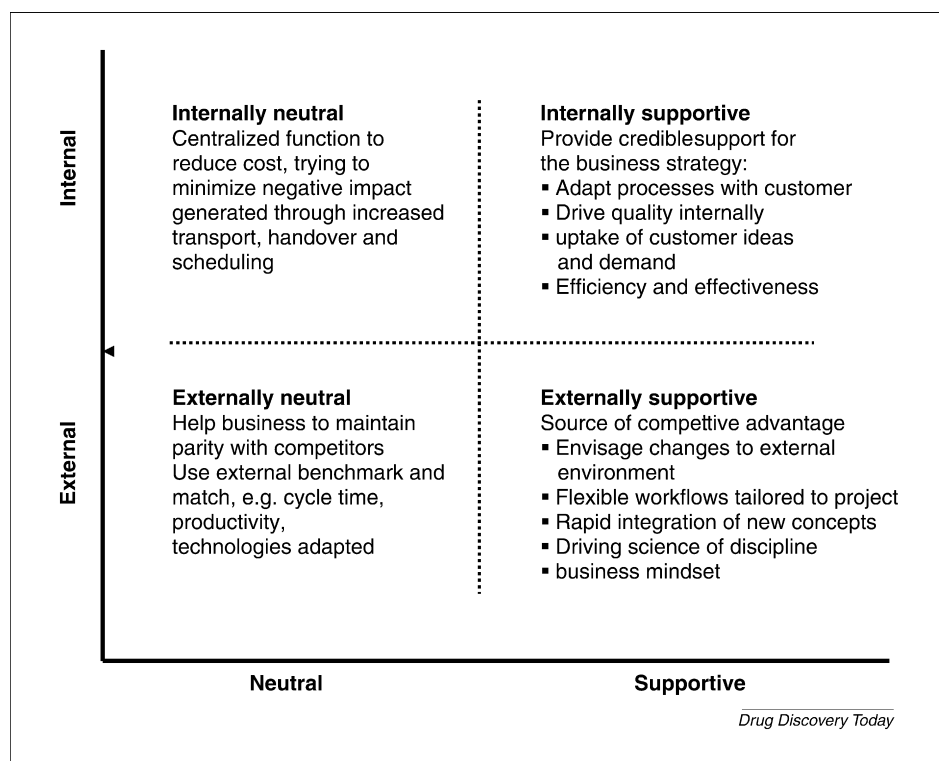
the organisation as a whole. Projects are driven by teams spanning multiple disciplines, but the introduction of support functions and the idea of service provision [4] have altered the balance. In addition, the 'outsourcing' of work to third parties, to gain further capacity, or where the work is regarded as 'non-core', has introduced questions about the role of individuals and 'value' of contributions into the mind of many colleagues. If we drive a service concept we will have to recognise the efforts appropriately within the organisation. It is interesting that we find partnership and willingness to adapt and collaborate almost easier in external collaborations compared to working with teams next door and it is only too easy for service teams to feel not included, not listened to and not appreciated. From an individual viewpoint, Studer [10] has gone so far as to suggest that 'thanks' should be a simple standard procedure against which managers are measured, as it is well documented that appreciation is highly motivating [13].

From the personal, and also the organisational, viewpoint, we believe that the value placed on a service is often directly related to cost and that it would be possible, and potentially helpful to the perception of internal service teams, to compare directly the internal with external efforts on a cost, time and quality basis. An expectation that teams would be judged and valued on these measures helps to develop a small company mindset even in big Pharma, where colleagues do believe that their individual contributions matter.

### Moving further ahead

There clearly has been change in our approach to managing operations in platform lines, but this change has been reactive, as the financial pressure has restricted resource, rather than being part of a forward looking strategy. To establish a world class service and department with a business mindset (Fig. 4), we have to move beyond pure accountability of all players to a real freedom to operate and compete with CROs around the world. For this we also need to establish realistic measures to address the true cost of outsourcing [15] where it uses internal services to assist delivery and, importantly, start to charge the internal customer in the therapeutic areas at a realistic rate for the service they consume. This will serve two purposes, firstly to make internal customers think about requests to internal providers, and, secondly, set the mind of colleagues working in the platform line and underline that a high class deliverable is expected.



**FIGURE 4**

Four-stage model for measuring the impact and performance of support functions (adapted after Neely [16]). The performance of operational functions can be assessed by analysing the level of support in the context of the internal and external environment. *Internally neutral*: minimising the negative impact only, that is in centralisation delivers cost advantages but can have a negative impact on workflows and cycle times. *Externally neutral*: focus on achieving parity when benchmarking against competitors. *Internally supportive*: the support function works with customers to develop science and processes to drive excellence. *Externally supportive*: the function provides competitive advantage through best in class performance in the area of expertise.

Budgets should contain a basic funding (on the assumption that the organisation wants to maintain some internal capacity) but should then be driven by fund transfer from internal customers. Where a better service can be obtained from an external provider, the internal service will necessarily act to improve and compete. To reward operational excellence we should move beyond performance-related pay for individuals to rewarding teams and whole departments. Excellent delivery as benchmarked against the external environment should also be used to provide additional funding against a business plan/strategy outline by the respective department. Decisions need to be local and less restricted by the overall company direction which can put restraints on teams that whilst appropriate in one situation are entirely unhelpful in another. We have to move away from the average strategy, for example making broad statements that the organisations spends too much on, for example, software licences,

equipment or contract resource. If the business plan and strategy of the department is approved we have to uncouple the local strategy from global restraints. Providing this freedom will drive the right attitudes and behaviours in our teams. Whilst all these measures may be difficult to implement and a challenge to accounting and finance systems, they will result in a true business mindset and entrepreneurship. Progress in the future is as much about culture as strategy. We need a good strategy to set our course to the right destination, but we need a good culture to take us there.

### Conclusion

The current pressure on the industry presents a unique opportunity to question underlying assumptions and redesign current systems of work. To build platform functions that truly enable project execution, we need new working paradigms and new ways of looking at how internal support is valued. This change will drive

different funding models, different organisational structures and different ways of thinking. We have to acknowledge that the skill sets and measures of success have to be adapted and that we have to find the right staff and motivation. If we simply continue with the current concepts of centralisation and economies of scale we will at best stagnate, but fail to unlock the true potential of creating competitive advantage through operational excellence.

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