

# Helping Workers Weather Crisis and Disruption: A Task Approach for Designing a New Future of Work

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# Key Takeaways

- When technology, globalisation, and the COVID-19 crisis dislocate entire sectors/ occupations, upgrading and upskilling along current occupation- and sector-specific initiatives risk being inadequate.
- We thus present a new task-based approach that rapidly and algorithmically charts multiple transition pathways across sectors. Our approach combines AI, human expertise, and a tasks-skills “database stack”.
- Tasks should be the focus because:
  - there is consensus in research and practice that tasks are the right unit of analysis to study the future of work.
  - similar tasks – and corresponding skills – shared by displaced jobs and new jobs form pathways along which workers can build on what they are familiar with to learn what is new and unfamiliar; this can reduce the difficulties (and even shock) they face during crisis and disruption.
- Policy makers, company leaders, and union leaders can use these highly granular aggregations to set organisational strategies and government policies.
- Three policy recommendations for adopting the task approach:
  - 1 Collect, incorporate, and integrate comprehensive and standardised task data into the employment and skills data that countries, cities, and companies already collect.
  - 2 Apply the task approach to re-skill and upskill workers within their industries/ professions and across them, and to do it in ways that reduce the barriers/ difficulties that workers face.
  - 3 Innovate in the research and application of the task approach, such as new combinations of tasks that make work more meaningful, and workers more resilient.

# 1 Introduction

In many countries, workers are facing great risks of displacement. The disruption wrought by digital transformation, globalisation, and more generally digitalisation, automation, AI and other advances that are driving the 4<sup>th</sup> Industrial Revolution, is now intensified by the economic dislocation from the COVID-19 crisis. The scale of displacement will be widespread and prolonged. Many workers will struggle to cope on their own. We will need to help them withstand and weather the disruption.

Current initiatives – such as conventional training and upgrading programmes – however, risk being inadequate.<sup>1</sup> This is because many of them are sector- or occupation-specific.<sup>2</sup> But when crisis, downturn, and disruption are dislocating entire sectors and occupations,<sup>3</sup> upgrading, upskilling and re-skilling within one’s sector or profession will hardly suffice. Workers will have to be upgraded, upskilled, and re-skilled to transition to new sectors and occupations.

This will be challenging. Current approaches for matching workers to opportunities remain largely manual, labour-intensive, and time-consuming. Even when the opportunities are within one’s sector or profession, countries, cities, and companies typically comb through voluminous reports and publications, commission costly studies, and corral multiple sources of data. These difficulties are compounded manifold when extended to matching workers to opportunities across different sectors and professions. Hence these cross-sector and -profession interventions are typically still relatively small in scale (in terms of the number of workers), while the effort demanded of the workers to transition is tremendous.

- 1 In an extreme – and hopefully isolated – example, workers who went for retraining ended up earning less than those who did not, as described in Goldstein, Amy. 2017. *Janesville: An American Story*. New York: Simon and Schuster.
- 2 The Australian national training system for vocational education and training, for example, explicitly states that “industry is at the centre of developing effective training packages” with Industry Reference Committees as part of the process for developing the packages – see Australian Industry and Skills Committee. (<https://www.aisc.net.au/content/national-training-system>).
- 3 The International Labour Organization has dedicated a website to the impact of COVID-19 on the world of work, and its analysis and recommendation are aimed at the sectoral level – see International Labour Organization. 2020. “COVID-19 and the world of work: Sectoral impact, responses and recommendations.” (<https://www.ilo.org/global/topics/coronavirus/sectoral/lang--en/index.htm>). For example, in tourism, the ILO states that the “impact on tourism enterprises and workers, the majority being young women, is unprecedented” and its policy brief points to tourism declining by as much as 78%. ([https://www.ilo.org/sector/Resources/publications/WCMS\\_741468/lang--en/index.htm](https://www.ilo.org/sector/Resources/publications/WCMS_741468/lang--en/index.htm)). This could in fact be understating the scale of the impact – in Singapore, for June 2020, tourist arrivals fell to 2170 visitors compared to 1.55 million in June 2019, a 99.9% decline. See Peeris, Jonathan. 2020. “Going virtual: COVID-19 pushes tourism players, visitors to adapt to a new reality.” Channel News Asia. (<https://www.channelnewsasia.com/news/business/covid-19-singapore-tourism-adapt-innovate-virtual-visitors-13120664>).

**W**e thus present a new task approach that takes on these challenges head on. The approach is based on our research collaborations with over ten organisations (from unions to global firms) in over ten sectors. Our work has been recognised by Singapore's National AI Strategy as an example of how countries and cities can build a trusted and progressive environment for AI that balances citizen interests and commercial innovation needs.<sup>4</sup>

**O**ur approach was first developed as part of an earlier inter- and multi-disciplinary project wherein we concluded that the nature of work was fundamentally changing at the resolution of tasks.<sup>5</sup> Since then, we have shown how we can use the granularity of tasks – combined with the insights from multiple disciplines – to give workers, company managers, and government leaders an alternative way to design a new future of work. A future where, because we use digital databases, AI, and human insight to integrate and link tasks across occupations, our designs are automated, human-centred, and scalable, and hence readily generated.

**T**his paper will thus review and describe how we are designing that future for workers. In doing so, we will illustrate five possibilities.

**T**he first is that the task approach is versatile. Our approach can rapidly and algorithmically chart multiple transition pathways between sectors, especially from disrupted sectors to less disrupted – even high-growth – ones. As mentioned earlier, this would otherwise be a massively manual, labour-intensive, and time-consuming effort. This will be particularly important when entire economic sectors and professions are dislocated (pandemics, lockdowns, and threats of successive waves of both being a case in point).

**O**ur task approach is also fast. Because we are using data analytics, algorithms, and AI, we can significantly reduce the time needed to do the matching and to chart the transition. Our approach also emphasises keeping the human in the loop. That means we can minimise algorithmic errors that might otherwise go undetected, leading to consequences that require substantial time and effort to rework.

**I**t is scalable. This is because we are using digital solutions (mentioned above). It is also because we are building on evidence found in multiple disciplines – such as labour economics and occupational psychology – which means we can readily draw on existing insights to interrogate new developments. We do not have to start completely from scratch.

**O**ur task approach is empowering. We emphasise the importance of building a shared vision of the future between workers, managers, and leaders, regardless of whether they are at the company, city, or country levels. They are all given the same information and analysis performed by our approach. This increases the odds that they will be better aligned, coordinated, and committed to the transitions.

<sup>4</sup> See Smart Nation Singapore. (<https://www.smartnation.gov.sg/why-Smart-Nation/NationalAIStrategy>).

<sup>5</sup> Poon, King Wang, Hyowon Lee, Wee Kiat Lim, Rajesh Elara Mohan, Youngjin Marie Chae, Gayathri Balasubramanian, Aaron Wai Keet Yong, and Raymond Wei Wen Yeong. 2017. *Living digital 2040: future of work, education and healthcare*. Singapore: World Scientific.

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Most importantly, what we do also takes into consideration humanistic values/ orientation. We can pinpoint at the task level which workers value and find meaningful in their jobs, and thus should be protected. As a result, our task approach is worker-centred because we can aim to protect and preserve the workers' dignity and wellbeing even – and especially – in the midst of tremendous change, disruption, and crisis.

Taken together, these five possibilities in our task approach underpin how we can design a new future of work. We discuss them in detail in the sections that follow.

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# 2 Why Tasks



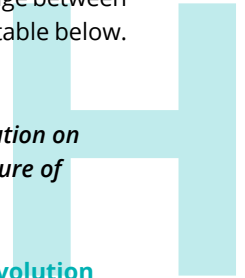
Our approach is based on tasks because there is rapidly converging consensus in the academic, practitioner and technology communities that the resolution of tasks – and work activities (which are categories of tasks) – is the right unit of analysis to study the impact of technology, globalisation, and economic changes on the future of work.<sup>6, 7</sup>

Why is this so? Conventional approaches view skills and tasks as being equivalent. Technological advances and business practices (such as outsourcing) have, however, changed that relationship between skills and tasks.

This can be understood at several levels. The first is the epochal change between the current and past Industrial Revolutions. These are summarised in the table below.

**Table 1: Comparison of the impact of the First and Fourth Industrial Revolution on work, workers, jobs, skills, and tasks. Adapted from *Living Digital 2040: Future of Work, Education, and Healthcare*<sup>8</sup>**

|              | First Industrial Revolution                                 | Fourth Industrial Revolution   |
|--------------|---|--|
| Similarities | Workers worry about job loss caused by technological change | Workers worry about job loss caused by AI and other technologies                       |
|              | Affected workers saw wages fall for decades                 | Affected workers see wages stagnate, and/or struggle to find new jobs with similar pay |
|              | Disenfranchised workers riot and protest against changes    | Disenfranchised workers riot, protest, and/or vote for change                          |



6 Acemoglu, Daron, and David Autor. 2011. "Skills, tasks and technologies: Implications for employment and earnings." In *Handbook of Labor Economics* 4:1043–1171. Amsterdam: Elsevier-North.

7 Autor, David. 2013. "The "task approach" to labor markets: an overview." *Journal for Labour Market Research* 46:185–199. (<https://economics.mit.edu/files/11638>).

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|             | First Industrial Revolution   | Fourth Industrial Revolution   |
|-------------|---|--|
| Differences | Processes were broken down into simpler tasks that required less skill, which de-skilled artisans but required more workers | Processes are broken down into a spectrum of tasks that disrupt and transform jobs across skills and skill levels, including the mid- and high-skilled |
|             | More jobs were eventually created than lost, and distress confined to specific sectors (e.g., hand weavers)                 | Risk: Disruption will be in multiple sectors as different skills and skill levels are affected   |
|             | Distress disappeared after one to two generations   | Risk: If distress persists, new societal fault lines will appear   |

There are many similarities between them but to understand the nature of change, it is important to pay attention to the differences. The critical difference lies in the way our work has been broken down. In the past, work processes were broken down into simpler tasks that required less skill. In the present, work processes are broken down into a spectrum of tasks across skills and skills levels, and these tasks could require less skill, more skill, or both.

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This change, in turn, has to do with the nature of digital technology. Digital technology is a general-purpose technology. This means that it can be adapted for a wide range of specific applications. These applications can cut across multiple sectors and occupations, with the consequent disruptions being equally wide ranging.

The nature of this change due to digital technology in the Fourth Industrial Revolution is likely to persist in the future. For example, Stanford University has concluded in its report on AI that in the foreseeable future, “AI systems [will be] specialised to accomplish particular tasks, and each application requires years of focused research and a careful, unique construction”.<sup>9</sup>

Moreover, global economics and prevailing business practices also rely heavily on tasks. Outsourcing over the decades has revolved around deciding which tasks can be done outside the company or economy.<sup>10</sup> More recently, gig work has also centred on tasks, usually intermediated via a platform.<sup>11</sup> In fact, David Autor has spelt out that “a growing body of literature argues that the shifting allocation of tasks between capital and labour – and between domestic and foreign labour – has played a key role in reshaping the structure of labour demand in industrialised countries in recent decades”.<sup>12</sup>

- 8 Poon, King Wang, Hyowon Lee, Wee Kiat Lim, Rajesh Elara Mohan, Youngjin Marie Chae, Gayathri Balasubramanian, Aaron Wai Keet Yong, and Raymond Wei Wen Yeong. 2017. *Living Digital 2040: Future of Work, Education and Healthcare*. Singapore: World Scientific.
- 9 Stone, Peter et al. 2016. *Artificial Intelligence and Life in 2030. One hundred year study on artificial intelligence: Report of the 2015–2016 Study Panel*. Stanford: Stanford University, (<http://ai100.stanford.edu/2016-report>).
- 10 Baldwin, Richard. 2016. *The Great Convergence*. Cambridge: Harvard University Press.
- 11 Baldwin, Richard. 2019. *The Globotics Upheaval: Globalization, Robotics, and the Future of Work*. New York: Oxford University Press.
- 12 Autor, David. 2013. “The “task approach” to labor markets: an overview.” *Journal for Labour Market Research* 46:185–199. (<https://economics.mit.edu/files/11638>).

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# 3 Jobs Are Disrupted Task by Task (Not Job by Job)

The combined impact and implication of all of these trends and developments is that jobs and work are changing not entire job by entire job, or skill by skill, but task by task. Acemoglu and Autor explain that this “distinction between skills and tasks becomes particularly relevant when workers of a given skill level can perform a variety of tasks and change the set of tasks that they perform in response to changes in labour market conditions and technology”.<sup>13</sup> A worker’s job and skill can remain the same but the task they apply that skill to in a job can change.

Hence, it would follow from the above discussion that to capture and understand what workers need to do in response, the right unit of analysis is tasks. Or to put it more colloquially, tasks is where the action is.

This converging consensus on tasks has seen consequent growth in its use in both research and practice. The *Oxford Handbook of Productivity Analysis* points out that task approaches are a “particularly appealing avenue for new analysis”.<sup>14</sup> Enrique Fernández-Macías and Martina Bisello explain that tasks are a better approach to adopt to study changes in employment and labour market structures.<sup>15</sup>

<sup>13</sup> Acemoglu, Daron, and David Autor. 2011. “Skills, tasks and technologies: Implications for employment and earnings.” In *Handbook of Labor Economics* 4:1043–1171. Amsterdam: Elsevier-North.

<sup>14</sup> Grifell-Tatjé, Emili, CA Knox Lovell, and Robin C. Sickles, eds. 2018. *The Oxford Handbook of Productivity Analysis*. New York: Oxford University Press.

<sup>15</sup> Fernández-Macías, Enrique, and Martina Bisello. 2018. “A framework for measuring tasks across occupations.” (<https://voxeu.org/article/framework-measuring-tasks-across-occupations>).



International organisations such as the World Bank and the International Labour Office have also used tasks in their future of work studies.<sup>16, 17, 18, 19</sup> Furthermore, the World Economic Forum has paid more attention to tasks in its studies of future jobs and skills.<sup>20, 21</sup>

In 2018, the Oxford Martin School put out a working paper in which they found that job transitions are more likely when viewed through the lenses of similar intermediate work activities (i.e., tasks shared by job families), than with other conventional dimensions such as skills.<sup>22</sup>

Acemoglu and Restrepo extended the use of tasks to examine the paradox of falling labour demand against rising productivity since the 1980s. By deconstructing economic production as a spectrum of tasks, they show how a “change in task content” – the net effect over time of the tasks displaced and reinstated – helps explain this paradox.<sup>23</sup>

More recently, the COVID-19 crisis saw the use of tasks to evaluate how “social distancing” measures are affecting the economy. Dingel and Neiman do this for the USA and 85 other countries by examining tasks across occupations, determining which could be done from home, and subsequently assessing the overall impact based on the total employment in those occupations.<sup>24</sup>

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- 16 Bussolo, Maurizio, Ivan Torre, and Hernan Winkler. 2018. “Does job polarization explain the rise in earnings inequality? Evidence from Europe.” (<https://openknowledge.worldbank.org/handle/10986/30879>).
- 17 Islam, Roumeen. 2018. “Sharing the benefits of innovation-digitization: a summary of market processes and policy suggestions.” The World Bank. (<https://doi.org/10.1596/1813-9450-8406>).
- 18 Gemmel, Patrik. 2016. “What are the effects of job polarization on skills distribution of young workers in developing countries.” ILO Policy Brief. (<http://www.ireg.ch/doc/etudes/2016-ILO-technical-brief-7.pdf>).
- 19 International Labour Organisation. 2018. “The impact of technology on the quality and quantity of jobs.” ([https://www.ilo.org/wcmsp5/groups/public/---dgreports/---cabinet/documents/publication/wcms\\_618168.pdf](https://www.ilo.org/wcmsp5/groups/public/---dgreports/---cabinet/documents/publication/wcms_618168.pdf)).
- 20 World Economic Forum. 2016. “The future of jobs: Employment, skills and workforce strategy for the Fourth Industrial Revolution.” Global Challenges Insight Report. ([http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf)).
- 21 World Economic Forum. 2018. “The Future of Jobs Report 2018.” Report. ([http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2018.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf)).
- 22 Mealy, Penny, R. Maria del Rio-Chanona, and J. Doyne Farmer. 2018. “What You Do at Work Matters: New Lenses on Labour.” SSRN Paper. (<http://dx.doi.org/10.2139/ssrn.3143064>).
- 23 Acemoglu, Daron, and Pascual Restrepo. 2019. “Automation and new tasks: how technology displaces and reinstates labor.” *Journal of Economic Perspectives* 33, no. 2: 3–30.
- 24 Dingel, Jonathan I., and Brent Neiman. 2020. *How many jobs can be done at home?* National Bureau of Economic Research Working Paper 26948. (<https://www.nber.org/papers/w26948>).

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# 4 Task Approach to Design the Future of Work

## 4.1 Overview – Two Simple “Rules”

Jobs are multi-faceted. At the same time, the activities in any job – in this case the job of an Information Security Analyst – can be broken down into its constituent tasks (each task is represented by a coloured dot). Once we have done so, we proceed to apply two simple “rules”.

The first takes advantage of the conclusion described earlier that jobs and work are changing not entire job by entire job, or skill by skill, but task by task. We can thus assess and identify the tasks that are disrupted by technology, globalisation, and/or a crisis, and when these will happen. This gives us an assessment of the speed, scale, and shape of disruption and the risk profile of that job (see the white Xs over selected dots on the left of the above figure).

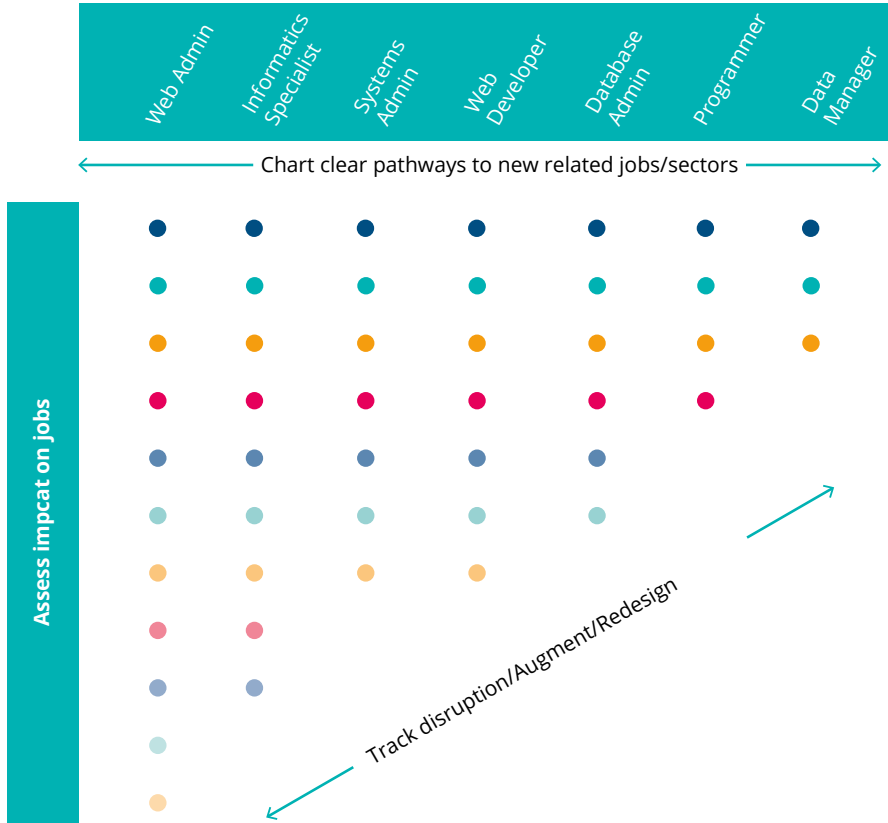
The second “rule” takes advantage of the relationship between tasks across jobs. Most jobs are not so specialised that their constituent tasks are only unique to that particular job. Instead, jobs tend to have some tasks that are similar to the tasks in other jobs. Using these similar or shared tasks, we can identify new and other jobs that a worker could move to (see the horizontal arrow in the above figure).

Figure 1: Task Approach showing how once jobs are broken down into their constituent tasks, we can assess how much an occupation will be disrupted, and which are the shared similar tasks across occupations so that we can determine possible transitions to other occupations (these are elaborated in the paragraphs below). Adapted from *Living Digital 2040: Future of Work, Education, and Healthcare*.<sup>25</sup>

## Information Security Analyst

### Tasks:

- Discuss user issues
- Train users, promote awareness
- Monitor virus reports
- Monitor security files
- Encrypt transmissions, erect firewalls
- Review user violations
- Develop plans to safeguard files
- Assess risks and execute tasks
- Coordinate implementations
- Document policies and procedures
- Monitor use of data files



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<sup>25</sup> Poon, King Wang, Hyowon Lee, Wee Kiat Lim, Rajesh Elara Mohan, Youngjin Marie Chae, Gayathri Balasubramanian, Aaron Wai Keet Yong, and Raymond Wei Wen Yeong. 2017. *Living Digital 2040: Future of Work, Education and Healthcare*. Singapore: World Scientific.

## 4.2 Charting Transition Pathways Within and Across Sectors and Professions

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Moreover, we can further assess these potential possibilities by repeating the first “rule”, i.e., identifying which tasks in these new and other jobs are likely to be disrupted by technology, globalisation, and/or a crisis. This analysis gives us the speed, scale, and shape of disruption of each of the new and other jobs. Armed with this assessment of their likely risk profiles, we can determine which of the transitions are more or less risky for workers to make.

We can do more. We can examine the tasks that remain to decide which technologies to invest in. For example, we can choose specific technology solutions to achieve specific objectives, such as making a job both more productive and more meaningful for workers. We can also look at all the tasks that remain and the technologies we could invest in, and combine these into new jobs as part of a larger workforce strategy, optimisation, and job-design effort.

Using the simple “rules” above, we can map concrete and granular task transition pathways from at-risk jobs to multiple new and other jobs in existing sectors and across different sectors.

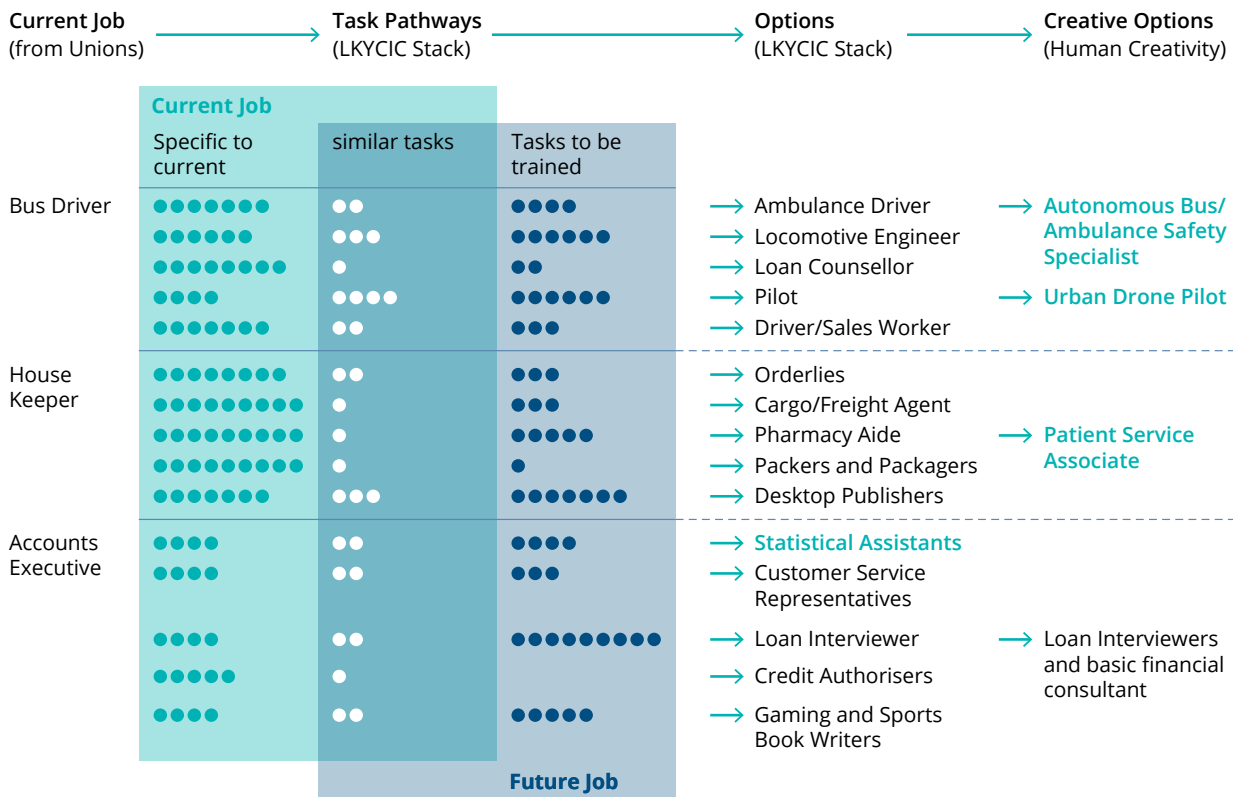
We illustrate this with our research collaboration with the unions.<sup>26</sup>

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<sup>26</sup> The unions are the Attractions, Resorts & Entertainment Union (AREU); Education Services Union (ESU); Food, Drinks and Allied Workers Union (FDAWU); Healthcare Services Employees' Union (HSEU); Metal Industries Workers' Union (MIWU); National Transport Workers' Union (NTWU); and United Workers of Electronics & Electrical Industries (UWEEI).

Figure 2: Charting Transition Pathways.<sup>27</sup>



On the left are the at-risk jobs. As outlined earlier, most jobs share some similar tasks. We take advantage of this by using an AI algorithm to generate new and other options that workers in at-risk jobs can move to (see middle column with the header “Options”). Importantly, these options include possibilities both within the workers’ current sectors/professions, as well as those across new sectors/professions.

Once these options are identified, we can also identify which tasks are not similar to those in the previous jobs. These tasks become the new tasks that the workers need to be trained in.

The above steps have several benefits. The first is clarity. Identifying different and new tasks to be trained in provides the workers – and any company or government agency helping them – with concrete steps they need to undertake to upgrade, upskill, and re-skill.

The second benefit is transition likelihood. Identifying similar tasks means the workers know what previous expertise and experience they can draw on to make the transition to the new/other jobs. Workers

<sup>27</sup> Poon, King Wang, Samuel Chng, Gayathri Haridas, Thijs Willems, Norakmal Hakim Bin Norhashim, Mohamed Salihin Subhan, Li Hui Sarah Gan, Zi An Galvyn Goh, Holly Lynn Apsley, and Radha Vinod. 2018. *Polarizing of Job Opportunities: Charting New Pathways and Adopting New Technologies*. Singapore: Ong Teng Cheong Labour Leadership Institute.

can thus build on the established and familiar in the present to subsequently learn what is new and unfamiliar for the future. This can increase the likelihood of transition, and reduce the difficulties – and possible shock – that workers can face when they are forced by circumstances to switch to new jobs and sectors.

Our task approach also provides a concrete way to shift mindsets. In addition to new and other options outside one's profession and sector, these alternative options can also include unexpected and unconventional possibilities. In the diagram above, this is the transition of a bus driver to a pilot. At first glance, this might not seem feasible. But as one union leader pointed out to us, that might reflect our mindsets more than reality. We might have allowed our expectations of what different workers could do to have narrowed unnecessarily, and this unexpected and unconventional option has expanded our sense of what is possible. Moreover, it could spur us to think more creatively. We could, for example, given the growing interest in smart cities and the use of drones for delivery, consider a transition that takes the form of an urban drone pilot in a smart city. Why might this growth opportunity be suitable? Urban drone pilots have to follow regulations and navigate a city safely every day – this is also what a bus driver does well daily. Once we have mapped out such creative transitions, it becomes intuitively feasible, and we have expanded the job possibilities for workers.

The expansion of potential possibilities spelt out in clear concrete steps via tasks offers a humanistic dimension.<sup>28</sup> Whether this expansion is from charting opportunities within and outside of one's sector/profession, from generating unexpected and unconventional options, or from designing with human intuition and ingenuity, they all have the potential to help workers feel more confident and hopeful about the challenges they have to face.

### 4.3 Current Limitations of the Task Approach

The task approach is not without its own peculiar set of limitations. The first limitation is endemic to any approach that uses data, which is the quantity and quality of the task data. We have found that countries, cities, and companies do collect task-level data, but they vary in how comprehensively and how often they collect them. There are also variations in the taxonomies and formats in which the data are collected. This first limitation can, fortunately, be overcome – all that is needed is some investment in time, effort and resources to ensure the data is properly prepared and standardised for subsequent use by the task approach and related algorithms.

The second limitation is common to new approaches that are sufficiently different from existing practices. Most countries, cities, and companies would already have existing initiatives to help workers. Their willingness and ability to incorporate a new approach, even when it is highly complementary, will vary for different reasons (such as resources, culture, mindset etc.). Any effort to introduce the task approach will thus need to be sensitive to these different reasons, and we have found that a collaborative engagement between open minds goes a long way toward overcoming this limitation.

<sup>28</sup> Goh, Zi An Galvyn, Norakmal Hakim Bin Norhashim, Radha Vinod, Holly Lynn Apsley, and King Wang Poon. 2019. "Oh gosh my job has been replaced by a robot! Investigating the perspectives of workers and employers considering job transitions via the Task-based approach." 19<sup>th</sup> Congress of the European Association of Work and Organizational Psychology. Italy: European Association of Work and Organizational Psychology.

The third limitation is that more research is needed to strengthen the humanistic dimension. Building confidence and hope as outlined earlier is only the first step. The multi-faceted nature of each job and what each individual finds meaningful about their job – whether it is pride, professionalism, pay, or social perception – can vary widely. These have implications on how we apply our approach and algorithms. It is also important that we guard against the possibility of the use of the algorithms leading to deterministic and dehumanising outcomes. Further work is thus necessary to carefully and critically expand the task approach’s application. We discuss some of these possibilities in the sections that follow.

#### 4.4 Doing More with Tasks

Charting transition pathways across sectors and professions is just one application of our task approach. The latter’s granularity and modularity means there are additional possibilities in how we can use tasks to design a new future of work.

##### Transforming Jobs to Strengthen Human Capability

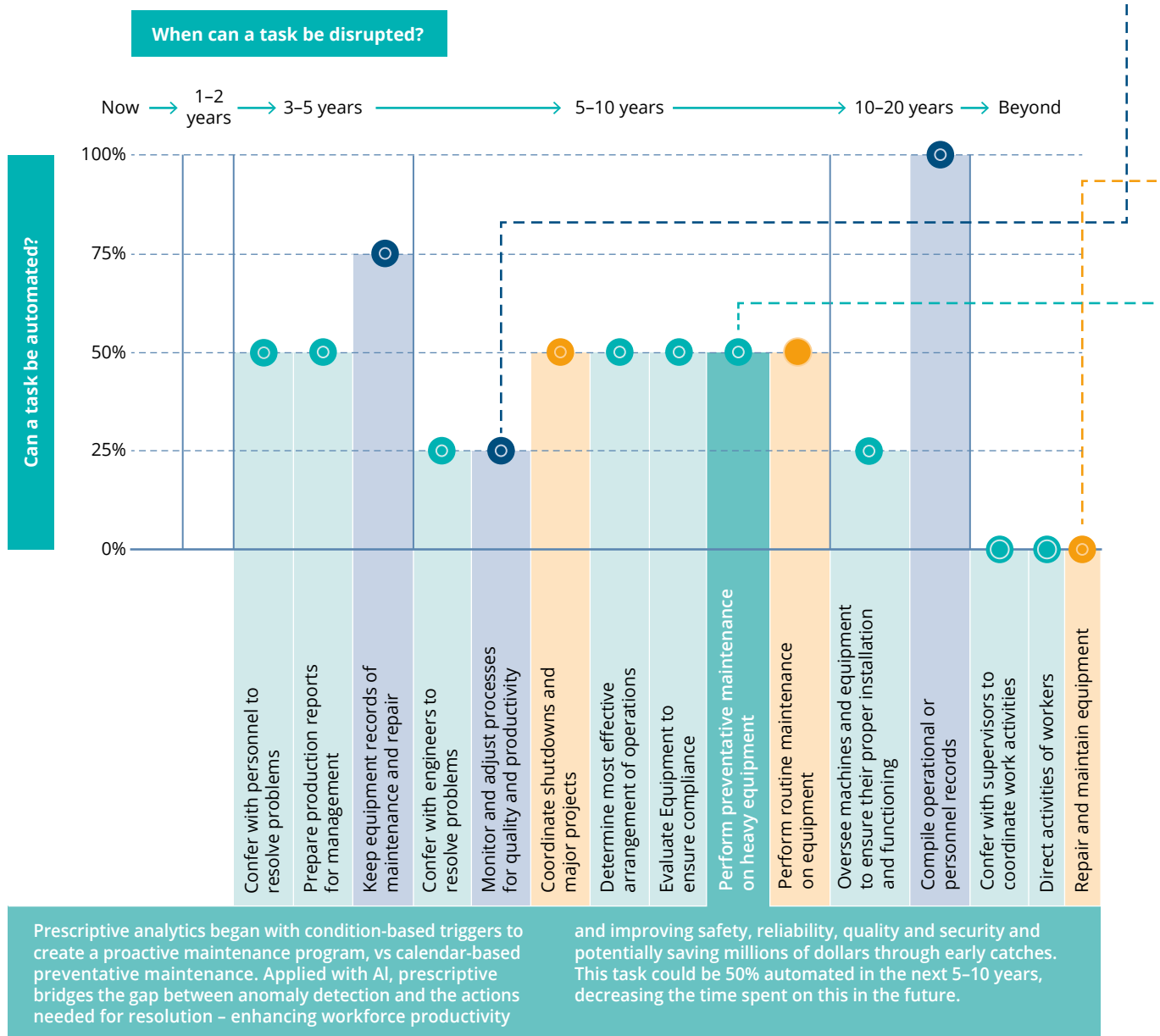
After a transition, we can use the task approach to systematically transform the job into one that is more meaningful, valued, and worker-centred.

We show how in our work with international think tank Live with AI, AI consultancy Data Robot, and four multi-national firms.

**Figure 3: Transforming Jobs.** This one-page transformation roadmaps lays out the technical and business possibilities for AI automation and disruption (left side of diagram), and the regulatory, social, professional, and human considerations for whether we should pursue those possibilities (right side of diagram). These are elaborated in the paragraphs below. The full set of transformation maps can be accessed at the *Live with AI* website. This work was recognised in Singapore's National AI strategy as an example of how we can build a trusted and progressive environment for AI that balances citizen interests and commercial innovation needs.

## Maintenance Technician (Advanced Manufacturing)

The maintenance technician serves as the frontline to maximize the performance of operation facilities in compliance with health, safety and environment policies and regulations. This role monitors and manages machinery condition in the field, trouble-shoots problems and performs repairs in collaboration with other functional teams and subject matter experts. This worker needs to execute necessary inspection as well as preventive/predictive/risk-based maintenance actions. As their domain knowledge and experience grows over time, they can be promoted to maintenance engineer.





## Should a task be automated?

### Should be automated

Monitor and adjust production processes or equipment for quality and productivity.



The work process for daily monitoring and adjustment can be tedious and cause fatigue for the technician. The monitoring, reporting and standard operation adjustment should be automated to relieve the human resource for more creative and effective tasks.

### Should augment humans

Receive predictive, prescriptive, and prognostic guidance in order to perform accelerated preventive maintenance on heavy equipment.



Thanks to Machine Learning and process mining, early warning insights can be delivered to the employees – they can leverage the rich database of maintenance and receive predictive, prescriptive, and prognostic guidance in order to perform accelerated preventive maintenance on heavy equipment. Employees then become part of the business development process, leveraging recommendations from specific software and sensors.

### Should remain in human hands

Repair and maintain equipment, making emergency adjustments or assisting with major repairs as necessary



This refers to the field work that carried out physically by technician. Although there could be enhancement from augmented robotic arms or other advanced machinery tools, this work includes case-by-case investigation and all the actions taken are specific. For example, underwater remote operation machines can help to inspect the offshore platform scaffolds, but we still need human to be the pilot remotely.

perfect match

#### What is valuable for the employee?

Repair and maintain equipment, making emergency adjustments or assisting with major repairs as necessary

**„This task was one that motivated me, because it involves solving a problem, gives a sense of accomplishment.“**

## How does the role change?

- It was highlighted that safety related tasks must be automated, for the employee security but also because of the potential impact an incident may have on the a society. A factory explosion due to a lack of regular controls for instance can be avoided. This type of incident can contaminate the water provision of cities for instance.
- A maintenance technician should get prepared for a deeper involvement with virtual augmentation, for example, dealing with early warning of equipment's integrity from its digital twin, or reviewing prescriptive suggestion of potential areas for inspection from virtual assistant powered by AI.
- Automation of monitoring and reporting process is a win-win for management level and frontline operations. The management will obtain most updated report in timely manner, the frontline workers will be relieved from the repetitive work with low satisfaction. The data archived can also be transformed as source for further AI development on machine maintenance.

- 29 Apsley, Holly Lynn, Norakmal Hakim Bin Norhashim, Zi An Galvyn Goh, Radha Vinod, Wee Kiat Lim, Eleonore Ferreyrol-Alesi, Pierre Robinet, Ming-Li Gridel, and King Wang Poon. 2019. "AI and Work: Equal to the Task." Live with AI 2019 White Paper: How to empower humans amid the rise of artificial intelligence in society, 36–63. Singapore: Live with AI.
- 30 See Live With AI. (<http://livewithai.org/read-live-with-ai-white-paper-2019/>).
- 31 See Smart Nation Singapore. (<https://www.smartnation.gov.sg/why-Smart-Nation/NationalAIStrategy>).

**I**n this research partnership, we broke down eight jobs across four diverse sectors into their constituent tasks. The assessment gave us a map of which tasks can be automated, the degree to which each of these tasks can be automated, and when they can be automated (see left of diagram).

**A**fter completing this assessment, for the tasks that could be automated, we discussed whether they should be augmented or left in human hands instead (see right of diagram). This is an important consideration, especially when the task that will be automated is a core human capability for the company. We have pointed out in previous research that while technology can improve the speed, accuracy and efficiency of how workers think and work, prolonged use of technology can also weaken workers' capabilities over time.<sup>32</sup> For example, when we automate cognitive tasks such as solving problems and making decisions, we risk diminishing our unassisted ability to "translate information into knowledge and knowledge into know-how".<sup>33</sup> This has been found to be the case across many jobs and sectors. These include accounting, financial trading, way-finding/GPS/navigation, architectural practice, game playing, programming, reading, spelling, and the effect on our memory of the ease of taking photographs and conducting online searches (e.g., we are more likely to forget certain experiences and facts).<sup>34</sup> By using the granularity of tasks to discuss what to automate, augment, or leave in human hands, we are better able to determine specifically the tasks and technologies wherein we can strengthen instead of diminish the workers' capabilities to do their jobs well.

**I**n addition, the task approach is useful for aligning the equally important consideration of what employees and managers value. We have found that there can be disagreement on this as the two parties often understand the nature of a job very differently from each other. By using a task approach, we are able to pinpoint specifically where there are differences, down to the task level. That level of detail makes them clear and concrete to all parties involved, improving communications and subsequent alignment.

## Meeting Policy Objectives

**W**e can combine the transition and transformation applications described above into multi-stage pathways. At the same time, because we can do these via an algorithm, we can build a series of multi-stage pathways to help achieve medium- to long-term socio-economic and environmental objectives. These pathways can in turn be the basis for engaging citizens and workers at a granular level (because they are at the level of tasks) on the future. Changes arising from these engagements with those most affected can be fed back into the algorithms to chart a new series of pathways that becomes the new basis for subsequent engagements.

<sup>32</sup> Poon, King Wang, Hyowon Lee, Wee Kiat Lim, Rajesh Elara Mohan, Youngjin Marie Chae, Gayathri Balasubramanian, Aaron Wai Keet Yong, and Raymond Wei Wen Yeong. 2017. *Living Digital 2040: Future of Work, Education and Healthcare*. Singapore: World Scientific.

<sup>33</sup> Carr, Nicholas. 2015. *The Glass Cage: Where Automation is Taking Us*. New York: W. W. Norton & Company.

<sup>34</sup> Balasubramanian, Gayathri, Hyowon Lee, King Wang Poon, Wee-Kiat Lim, and Wai Keet Yong. 2017. "Towards establishing design principles for balancing usability and maintaining cognitive abilities." International Conference of Design, User Experience, and Usability. 3–18. Cham: Springer.

In our ongoing work, these include:

- 1 Charting pathways between disrupted jobs to jobs envisioned by a company or country (e.g., a future healthcare system, a more sustainable economy etc.). The pathways can, in turn, be used by workers, companies, and government agencies to prepare the workforce for that envisioned future.
- 2 Charting bi-directional pathways between salaried employment and gig work. This expands options for workers who might alternate between these two modes of work as a career choice, life choice (e.g., young parents, temporary caregivers etc.), and/or as choice forced upon them by circumstances (e.g., when they lose their jobs or gig work and need an alternative to tide them through). These bi-directional pathways can be designed to maximise the possibility that they complement each other so that workers can use them in combination to secure better future opportunities.

## Ensuring Well-Being

As technology, globalisation, and crises change what we do in the workplace, these shifts will affect our well-being too.<sup>35</sup> Current employee well-being research tends to study well-being at the entire job level. In our ongoing work, we use our task approach to extend the conventional models of burnout and motivation to the task level. Our preliminary work suggests that with a task approach, we are able to develop a deeper understanding of what workers find energising and exhausting. These in turn make it possible for us to design interventions that are more targeted in improving employee well-being.<sup>36</sup>

## Building a Task-Skills Stack

We are able to apply our task approach across a wide spectrum of applications because we have been building a task-skills “database stack”. In this tasks-skills stack, we draw on the lessons of the USA O\*NET.<sup>37</sup> We standardise the definitions of tasks across jobs, skills, and competencies. These tasks are specified to multiple levels of details, from tasks specific to a particular job to tasks shared by a large number of jobs across the economy. In addition, we are in the process of aligning our data with a growing number of data and information sources, such as the employment and labour data found in companies and governments.

By using AI and our tasks-skills stack, we can easily aggregate the worker-level data and information at the company and sector levels. Policy makers, company leaders, and union leaders can subsequently use these highly granular

<sup>35</sup> Goh, Zi An Galvyn. 2019. “Can Our Well-Being at Work Be Improved in the Age of AI?” *Live with AI 2019 White Paper: How to Empower Humans amid the Rise of Artificial Intelligence in Society*, 86–88. Singapore: Live with AI.

<sup>36</sup> Goh, Zi An Galvyn, Norakmal Hakim Bin Norhashim, Radha Vinod, Holly Lynn Apsley, Devesh Narayanan, Zhi Ming Zach Tan, and King Wang Poon. 2020. “Development of a Novel Method to Apply the Job Demands-Resources Model in Job Tasks.” *Institute of Work Psychology International Conference*. United Kingdom: Institute of Work Psychology.

<sup>37</sup> The USA Occupational Information Network is a free digital database with occupational definitions for use by citizens, companies, and policy makers.

aggregations to design the organisational strategies and government policies needed to help workers withstand and weather downturns and disruptions.

At the same time, we keep the human in the loop as we build our tasks-skills stack. We start with the definitions and mappings already identified in research, such as in the fields of occupational psychology and labour economics. As we understand that work, jobs, skills, and tasks are multi-faceted, we then verify and validate data against worker experiences, engaging workers as part of the process. For example, even though we are using AI and digitalising the charting of pathways, we augment these with human expertise for the unique contextual knowledge specific to different jobs and sectors. These also mean that we retain control over the AI, ensuring it is beneficial and that it serves objectives focused on meeting human needs.<sup>38</sup>

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<sup>38</sup> Russell, Stuart. 2019. *Human Compatible: Artificial Intelligence and the Problem of Control*. London: Penguin.

# 5 Conclusion

Our task approach builds on the research evidence on the growing role of tasks in the future of work. Through our partnerships with unions and companies, we have attempted to advance the theories and application of those theories and related concepts found in the research literature.

Our task approach complements the investments in skills that many workers, companies, and countries have made. In fact, we believe it increases the value of those investments. Because jobs are now disrupted task by task, and not job by job or skill by skill, tasks provide the right unit of analysis to pinpoint the skills we need for the future, and how our jobs are changing as a result.

Arising from the above, there are at least three recommendations that policy makers in governments and strategists in companies could consider.

The first is to collect, incorporate, and integrate high-quality and comprehensive task data into the work-related data that countries, cities, and companies are already collecting (such as employment numbers, jobs, skills, and competencies). The tasks should be collected according to a standardised taxonomy/format, and take full advantage of the information and tools that are already digitally available.

The second is to apply the task approach to the re-skilling and upskilling of workers, whether these are within the workers' industries/professions or across other industries/professions. Applying the task approach for re-skilling and upskilling would include breaking down the re-skilling and upskilling journeys into the granularity of tasks so that workers can clearly see the steps they need to take. The training – whether done formally or on-the-job – can also be optimised for these journeys. The cumulative effect should reduce the barriers and difficulties that workers often face in re-skilling and upskilling.

The third recommendation is to innovate in both the research into and application of the task approach. The granularity of tasks gives it a modularity that makes it possible to turn tasks into building blocks for improving existing and creating new designs of work. Besides the possibilities painted earlier, we can for example also look into new combinations of tasks that make work more meaningful, and/or that strengthen workers' resilience to uncertainty. In doing so, companies, cities, and countries can better re-design existing work and design new work.

**U** As we have detailed in the preceding paragraphs, this is just the beginning. We can chart clear and concrete transition pathways between disrupted jobs to new and other jobs and sectors, especially in a crisis. We can subsequently transform the jobs to strengthen human capability in the tasks that matter the most to worker, company, and national economic performance. We can ensure these jobs protect the well-being of the workers as they grapple with the changes. Finally, we can design jobs to achieve not just short-term goals, but also medium- to long-term socio-economic and environmental objectives.

**W** With the use of digital technologies, AI, and a tasks-skills stack, our task approach can be faster, more versatile and more scalable compared to conventional approaches. Most importantly, because we emphasise the human in the loop, we can use the task approach to empower workers and to design a new and humanistic future of work. One that helps workers weather crisis and disruption in these uncertain times.

**N**

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