

DISTRIBUTION OF HOME-BASED WORK IN CITIES: IMPLICATIONS FOR PLANNING AND POLICY IN THE PANDEMIC ERA

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Abstract: The rapid growth of home-based work raises questions about its long-term impacts on neighbourhoods and cities. By removing the need to commute, home-based work has the potential to advance the New Urbanism aspirations of walkable neighbourhoods in an urban village format where people live, work and play. Nonetheless, the uneven distribution of this emerging work practice, strongly associated with the socio-economic status of neighbourhoods, is exacerbating the risk of increased urban inequalities. This paper presents pre- and post-COVID data for the City of Gold Coast, Australia, and it discusses the urban distribution of home-based work by analysing the home-based workers' locational preferences, their daily movement patterns, the preferred built environment outcomes, and the urban design features. The findings suggest that certain social and economic interactions tend to increase with the growth of remote work. These interactions, magnified by the COVID pandemic, offer opportunities to advance the New Urbanism aspirations of cohesive, walkable communities and neighbourhoods.

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Introduction

Since early 2020, cities around the world have frequently endured strict lockdowns implemented as COVID-19 disaster management responses. The streets quickly emptied, with shops closed and office employees working flexibly from home, free from the burden of daily commutes to the office. With the gradual ease of lockdown restrictions, home-based work has become a choice again, rather than a directive, and many employers have chosen to introduce it as a permanent work arrangement option for their staff. Whilst post-pandemic data on the volume of home-based work in cities is still emerging, there is a broad consensus amongst researchers, economists, and policymakers that remote work, particularly work from home, has grown significantly (Bartik et al. 2020, Batty 2020). It has become an attractive alternative to office-based work, potentially permanently changing the work location landscape of cities. Home-based work has shifted from being a niche, but a desirable way of working, towards the mainstream, and in the process, it has created, among other things, an interesting research space for socio-economic studies concerning its impact on productivity, work–life balance, mental health, and gender diversity.

Another interesting, yet insufficiently explored, field of research is to investigate the impact of home-based work on cities through an urban planning perspective — for example, whether home-based work advances the ideals of New Urbanism, a planning movement promoting diversity of land use, pedestrian scale, and self-contained neighbourhoods (De Villiers 1997, Smith 2002). Other areas of investigation include whether local shopping centres can be retrofitted as hubs for collaboration and networking to address home-based workers' need for social interaction and digital connectivity, and how home-based work affects the demand for road infrastructure upgrades. Finding answers to these and many other urban planning and policy questions requires developing insights into (i) the distribution of home-based work in cities, and (ii) understanding how workers' daily routines, patterns and destinations change once they begin to undertake work from home.

The distribution of home-based work is difficult to measure due to challenges in obtaining accurate data on the volumes of the workforce engaged in this type of work. In Australia, pre-pandemic figures are available through the 2016 Census (Australian Bureau of Statistics 2017), which reveals an uneven distribution in Australian cities: in some neighbourhoods, this particular type of work accounts for over ten per cent of the local workforce, whilst in other residential parts of the same city, home-based work is almost non-existent. Prior to the pandemic, this distribution was attributed to access to technological innovations — such as broadband internet access and teleconferencing capabilities — enabling remote work, and locational preferences of knowledge workers who tend to concentrate in certain kinds of regions or clusters (Moos and Skaburskis 2007, Brennan-Horley 2010, Hearn 2020, Rodríguez-Pose and Storper 2020).

One scenario for post-pandemic cities is that the rapid growth of remote, home-based work will enable planning for compact, walkable neighbourhoods (Moreno et al. 2021). Yet, as mentioned in the previous paragraph, this growth is unlikely to be evenly distributed, bringing a risk of spatially inscribed inequalities, which could limit the capacity of cities and neighbourhoods to advance sustainable economic, environmental, and social processes (Sampson 2017). Prior to the pandemic, the problem of inequalities within cities was described as pervasive and persistent (Sampson 2017), with post-pandemic growth of home-based work in certain parts of cities being likely to trigger further divergence amongst urban neighbourhoods. In this scenario, neighbourhoods with a high proportion of home-based work may evolve over time towards being attractive environments delivering the New Urbanism aspirations of walkable urban villages – cohesive, self-sustainable places able to cater for residents’ needs in place. At the same time, neighbourhoods less likely to host a substantial proportion of home-based workers are likely to miss out. In this context, planning deliberations on the topic of home-based work require an additional theoretical focus on the social structure of cities and their neighbourhoods.

Our paper makes a step in this direction by analysing the pre-pandemic spatial distribution of home-based work and by assessing home-based workers’ daily movement patterns, urban interactions, aspirations, and needs. The overarching research questions of this paper are as follows:

1. Which socio-economic factors influence the distribution of home-based work in cities?
2. To what extent does home-based work exacerbate geographic inequalities in cities?
3. What is the impact of COVID-19 on these questions and the future of home-based work?

The paper offers a timely analysis of the distribution of home-based workers against key socio-economic dimensions using two sources: (1) pre-COVID-19 data as captured in the most recent (2016) Australian census, and (2) post-COVID-19 data from a survey carried out in October and November 2020. In the census-based analysis, we address the theory formulated by Reuschke and Houston (2016), who linked the distribution of home-based businesses to shared trajectories leading certain people to the same location (selection effect), rather than the spill-over effects enabled by the virtue of spatial clustering. The second part of the paper provides an analysis of a survey (n=887) undertaken in the City of Gold Coast in Queensland, Australia, in October and November 2020. The survey invited local home-based workers to share their experiences, particularly the benefits and barriers, the frequency of certain daily activities, and the preferences for future changes to the built environment of cities.

Literature review

The purpose of this literature review is to situate our research question in the context of the current academic discourse on the contemporary urban planning agenda, the ongoing economic restructuring of cities and the recent impacts of the COVID-19 pandemic. Throughout this paper, we use the definition of home-based work proposed by Chen and Sinha (2016: 343): “home-based workers produce goods or services for the market from within or around their own homes”.

The rise of New Urbanism in the 1990s attempted to push back against the consequences of car-oriented modernist planning, especially the daily commute and its associated traffic congestion, environmental costs and negative impact on the lifestyle. The New Urbanism paradigm offered an evolving set of planning and design principles promoting walkability, density, mixed-use and quality design (Smith 2002). One of the New Urbanism concepts — the ‘urban village’ — has gained popularity for its embedded notion that people should have the opportunity to live and work within one neighbourhood (Biddulph et al. 2003, Carroll et al. 2007, Foth et al. 2008). In the context of Australian car-dependent cities, the New Urbanism offers opportunities to reduce urban sprawl and car dependency and to improve societal well-being through urban renewal towards pedestrian-oriented streets and neighbourhoods (Falconer et al. 2010, Trudeau 2013).

Moreover, regardless of the intellectual efforts of researchers and planners advancing the New Urbanism agenda, cities are subject to ongoing dynamics, or mega trends (Hajkowicz et al. 2012), with one of these being economic restructuring from industrial to post-industrial labour markets (Burgers and Musterd 2002). This restructuring, fuelled by the globalising economy, and the increasing role of knowledge and technological innovation (Hearn et al. 2014) is democratising production by lowering barriers to entry (Thomson and Jakubowski 2012) for small-scale entrepreneurs. The result is that work is encroaching into suburbia (Glaeser and Kahn 2003, Flew et al. 2012), and remote — particularly home-based — work continues to grow in popularity, and it has become spatially significant (Holliss 2015), somewhat irrespective of the urban village aspirations promoted by the New Urbanism agenda.

In the social sciences, the growth of home-based work is often attributed to several interrelated processes: technological advances, changing lifestyle preferences, empowered individuals, and globalising networks of knowledge (Glaeser 2012, Moretti 2012). Economists, on the other hand, often position technological advances as facilitators of contingent work, as they enable firms to outsource non-core parts of their activities (De Stefano 2016) and to assist their employees to work flexibly (Houghton et al. 2018). From either perspective, work has been facing unprecedented locational flexibility, fostering the ongoing spatial deconcentration of economic activities and

changing the urban landscape of entrepreneurship by spreading away from the cities' traditional central business districts towards residential suburbs and new genres of mixed-use knowledge precincts (Reuschke et al. 2015, O'Hare 2016, Mengi et al. 2020). One dimension of the increased popularity of work across different locations is the growth of work performed from home (Felton et al. 2010, Mason et al. 2011, Holliss 2015, Reuschke and Houston 2016).

According to the 2016 Australian Census of Population and Housing (Australian Bureau of Statistics 2017), approximately 5.55% of the workforce in Australia worked from home before the COVID-19 pandemic. This figure does not account for part-time home-based businesses established as a secondary source of income and home businesses focused on providing services away from home (e.g. tradespeople). When these are included, the figure has been estimated at around 20 percent of the workforce (Burgess and Strachan 2002). However, the spatial distribution of home-based work in Australian cities is not even: certain neighbourhoods have substantially greater proportions of home-based workers than others. Exploring this phenomenon, Moos and Skaburskis (2007) found that the distribution generally follows sectoral occupational classifications. A similar conclusion was reached by Brennan-Horley (2010) in an analysis of the spatial distribution of creative self-employed entrepreneurs based in Darwin.

In a comprehensive review of contemporary theories explaining the location of workers, Storper and Scott (2009) noted that people make locational decisions chiefly in response to 'amenities,' that is, certain features of the urban environment (Chen and Rosenthal 2008). These include the housing choice, the amenities of the local environment, the quality of urban design, the availability of public spaces of a certain kind, opportunities for local interactions, educational institutions, safety, and the broad economic prosperity of the area or city. Similar observations have been offered by Buch et al. (2014), who also pointed to the significance of natural attractiveness, and the availability of consumer facilities and public goods. Some further insight into locational preferences (Table 1) has been offered by Kim et al. (2005), in an examination of how places vary in their attractiveness to people who are relocating, including in terms of offering different types of residential stock and house prices. In an older study, Weisbrod et al. (1980: 9) noted that the factors influencing locational decisions are "often beyond the scope of public policy," and include, for example, the desire for single-family detached homes among the families with children and the reduced frequency of location change for older persons and families with several children. These findings have been echoed in more contemporary studies by Cheshire and Sheppard (1995), Lee et al. (2019), Letdin and Shim (2019).

The COVID-19 pandemic forced firms into an enormous experiment concerning home-based work. At times during the pandemic, over a third of workers who had previously

commuted to the office shifted to working from home (Brynjolfsson et al. 2020). This shift was more common amongst the employees with higher earnings (Kramer and Kramer 2020, Messacar et al. 2020). It is yet to be determined to what extent this new work arrangement will impact on productivity and the creativity of workers; however, the emerging literature indicates that, in the future, work will be split between the office and a remote (predominantly home) location (Bartik et al. 2020, Batty 2020). There is an expectation that many people who have been working from home because of the pandemic may well continue to do so in a full-time or part-time capacity, with estimates that up to 40% of all workers are able to perform their work from home (Batty 2020). Delventhal et al. (2022) modelled the scope of changes in large urban areas, such as Los Angeles, if telecommuting becomes popular in the long run. Their research found substantial changes to wages, the city structure, real estate prices, and commuting patterns.

Table 1. Key factors influencing locational preferences

Factor	Source
Socio-economic status of the area	Kane and Clark (2019)
House price	Kim et al. (2005)
Education	Chen and Rosenthal (2008), Letdin and Shim (2019)
Income	Letdin and Shim (2019)
Family composition	Weisbrod et al. (1980), Letdin and Shim (2019)
Housing choice, amenities, safety, quality urban design	Storper and Scott (2009)
Natural attractiveness, cultural infrastructure, city size	Buch et al. (2014)
Coastal areas	Chen and Rosenthal (2008)

The combined effects of these processes — continuing economic restructuring, the growth of remote work, urban–regional mobility and, more recently, the COVID-19 pandemic — suggest that the importance of geographical and historical place-specific factors is likely to grow (Mengi et al. 2020). The argument here is that globalisation, instead of leading to homogeneity among locations, deepens the differences between them, and in an age of rapidly increasing mobility, ‘place’ becomes more, not less, important. Local or regional conditions may produce markedly different situations in terms of social inequality and social patterns in cities (Massey 1995, Burgers and Musterd 2002, Storper 2018) and the effect of inequality decreases the absolute incomes of low-income neighbourhoods and it increases the absolute income of high-income neighbourhoods, due to the effects of inequality on the individual income distribution (Modai-Snir and Van Ham 2020). What follows is that the divergent new geography of income and jobs is also becoming a divergent new geography of lifestyle and economic opportunities (Moretti 2012, Horner and Hulme 2017).

Methodology

Study area

The case study city is the City of Gold Coast in Queensland, Australia. With a population of just over 600,000 people, it is the second largest city in Queensland and one of the fastest growing cities in Australia, with a population forecast to reach over 730,000 people by 2026, an increase driven by its pleasant subtropical climate and relaxed lifestyle (City of Gold Coast 2022).

The City of Gold Coast is located in the South-East Queensland region of over 22,000 km² and 3,800,000 residents (Australian Bureau of Statistics 2021), centred on the state's capital city Brisbane (Figure 1). It originates from a network of beachside villages, which have been a destination for local, Brisbane-based holidaymakers since the 1870s. The rapid growth of the South-East Queensland region has resulted in its key urban centres (Brisbane, Ipswich, Sunshine Coast and the City of Gold Coast), forming one large agglomeration accommodating approximately 75,000 new residents each year, with about 33% of residents born overseas (Dedekorkut-Howes and Bosman 2015). The popularity of the City of Gold Coast as a desirable, relaxed place to live results in a high ratio of home-based work compared with other major Australian cities (Australian Bureau of Statistics 2017).



Figure 1. Location of the City of Gold Coast, Australia.
Source: after Dedekorkut-Howes and Bosman (2015)

The opportunity to work from home, facilitated by the ongoing technological advances, has been made available to many residents who in the past commuted to Brisbane for work. Today, the City of Gold Coast is widely regarded as Australia's most

popular holiday hotspot, attracting approximately 5.3 million visitors each year (Destination Gold Coast 2019). Tourism accounts for 13.8% of the gross regional product to the local economy and it employs one in six residents. In recent years, the city's popularity as an amenity-driven destination has had a role in diversifying the city's economy (O'Hare 2016), with strong employment growth observed in sectors such as digital creative services, freelancers/sole traders, and consulting organisations, which compete for large public sector tenders (Houghton et al. 2018). These new businesses and jobs are often part of the local community of co-working hubs (Bilandzic and Foth 2013), which were becoming increasingly common across the city before the COVID-19 pandemic.

Method

As mentioned above, this study draws upon two empirical data sources: (1) pre-COVID-19 data originating from the most recent (2016) Australian census (Australian Bureau of Statistics 2017), and (2) post-COVID-19 data from an October/November 2020 survey of home-based work. The first component of the research, based on the 2016 Australian Census (Australian Bureau of Statistics 2017), involved the statistical univariate analysis of variance of the socio-economic neighbourhood features that are related to the frequency of home-based work. The number of home-based workers in Australia is recorded in the Census 'Journey-to-work' data, sourced from the ABS 'Table Builder' online tool. Data on the method of travel to work records the method(s) that a person used to get to work on the Census Day (9 August 2016), for all employed persons aged 15 years or older. One of the suggested responses in the census form was "worked from home." The census features associated with the socio-economic status of the neighbourhoods were chosen based on the literature review. The geographical unit of analysis is the Australian Statistical Geographical Standard's Statistical Area 1 (SA1), a fine-grained level of detail enabling the analysis at a localised neighbourhood level. Some data items were simplified to enable a more straightforward interpretation of the analysis: housing, car ownership and education categories were collapsed into one indicator variable (Table 2).

An initial exploration of the independent variables showed that there were strong correlations between several socioeconomic descriptor variables. Examining the nature of the relationships between the socioeconomic variables revealed the following:

1. There is a strong relationship between the variable internet access and the socio-economic variables (the OLS regression relationship between Internet access and the full set of socioeconomic variables resulted in an R squared of 0.766). As we wish to explore the direct relationship between the socioeconomic indicators and home-based work, we have excluded the internet access variable from the analysis.

2. There were high and significant Pearson correlations (greater than ± 0.5) between two-plus cars and internet access, owning a home or having a mortgage, detached housing, mid-rise housing, and high-rise housing. Three-plus bedrooms had high correlations with the same set of variables.
3. Testing these variables using ordinary least squares collinearity statistics showed that the following variables had high VIF statistics (greater than 10): detached housing, mid-rise housing, and high-rise housing. Two-plus cars was greater than 9.

Table 2. Variable definitions and descriptive statistics

Name of variable	N	Minimum	Maximum	Mean	Std. Deviation
Home-based workers (proportion of workforce)	1188	0.0000	0.2476	0.0638	0.0389
Distance to beach (m)	1188	0	33761	7511	6839
Population	1188	63	3522	461	203
Median weekly income (A\$, 2016 dollars)	1188	462	1521	869	145
Median hours worked	1188	14	34	27	2
Median age	1188	24	76	40	7
Median monthly mortgage repayment (A\$, 2016 dollars)	1188	900	3200	2018	403
Internet access (proportion of people)	1188	0.2798	1.0000	0.7569	0.1146
Owens home or has mortgage (proportion of dwellings)	1188	0.0000	1.0000	0.6629	0.2094
Two-plus cars (proportion of dwellings)	1188	0.0973	1.0000	0.6275	0.1887
Three-plus bedrooms (proportion of dwellings)	1188	0.0140	1.0000	0.7888	0.2873
Post-high school education (proportion of residents)	1188	0.0340	0.7500	0.3001	0.0888
High school education (proportion of residents)	1188	0.3787	0.9660	0.6984	0.0871
Employment managers and professionals (proportion of workers)	1188	0.0087	0.3030	0.1464	0.0455
Employment sales (proportion of workers)	1188	0.0000	0.1111	0.0571	0.0167
Detached housing (proportion of dwellings)	1188	0.0000	1.0000	0.6510	0.3805
Mid-rise housing (proportion of dwellings)	1188	0.0000	1.0000	0.2704	0.3227
High-rise housing (proportion of dwellings)	1188	0.0000	1.0000	0.0621	0.1930
Five-year mobility (proportion of residents) ¹	1188	0.1304	1.0000	0.3817	0.1185

Considering these observations, we have minimised the potential for multicollinearity to bias this analysis by excluding two-plus cars, detached housing, mid-rise housing and high-rise housing. This leaves us with the following model:

$$HBW = Beach + Pop + Inc + WkHrs + Age + MtgPymt + OwnHome + 3PIBeds + PostHSEd + Mgr + Sales + Mobile \quad (1)$$

where, *HBW* is proportion of employed people working from home, *Beach* is distance to the beach, *Pop* is population, *Inc* is Median income in 2016 Australian dollars, *WkHrs* is median hours worked, *Age* is median age, *MtgPymt* is median monthly mortgage payment, *OwnHome* is proportion of dwellings owned or mortgaged by their residents, *3PIBeds* is proportion of dwellings with three or more bedrooms, *PostHSEd* is proportion of residents with post-high school education, *Mgr* is proportion of workers who are classified as managers or professionals, *Sales* is proportion of workers in sales roles, and *Mobile* is proportion of residents who have moved in the last five years.

To minimise the risk of the modifiable areal unit problem (MAUP), the analysis presented in this paper was focused on spatial areas available at the smallest possible meaningful geographical scale of SA₁ (Tuson et al. 2019), which is considered the most likely to isolate neighbourhood effects (Learnihan 2011, Hanigan et al. 2017).

The second component of the research involved an online survey post-COVID-19. In October 2020, the City of Gold Coast Council, in collaboration with Queensland University of Technology, launched an online survey asking the city's residents to share their experiences of how working from home has changed their daily interactions with their neighbourhood and the city. The sampling targeted the city's residents who, at the time of the survey, worked from home at least one day a week. A specific engagement plan was prepared to increase participation rates, and council marketing and engagement channels were deployed to promote the survey amongst the local community. A total of 887 surveys were completed. The timing of this research was aligned with the Queensland state government's gradual easing of COVID-19-related restrictions. In Australia, a nation-wide lockdown including a work from home order was in place from April to May 2020. Strict border control helped Australia avoid the recurring waves of the pandemic at that time, and lockdown restrictions were gradually lifted in the weeks following May 2020. By August 2020, the economy had largely reopened, and whilst the tourism and education sectors continued to suffer due to international border closures remaining in place, resident Australians were generally able to return to their pre-pandemic lifestyles. In this context, the home-based work survey was scheduled to take place in October 2020, because by that time, life in the case study city had largely already returned to the pre-pandemic norm, whilst home-based work remained available as a conscious choice for many employers and employees.

The survey comprised three sections: experience, daily interactions, and big ideas for the future of home-based work. The survey was led and managed by the local council,

with the authors of this research paper engaged to assist in the preparation of the survey format and questions and the data analysis.

To determine whether the survey delivered statistically significant results, it was conservatively assumed that the number of home-based workers peaked during the lockdown at about 70% of that part of the working population which could work from home (Bick et al. 2020). It was further assumed that five months after the lockdown was lifted, when the survey was undertaken, this figure had decreased from 70% to 45% (Barrero et al. 2021) — that is, from approximately 90,000 employees to just over 60,000. Under this assumption, the results of the survey can be considered representative of the population of the City of Gold Coast with a 95% probability ratio. The results of the survey were analysed using the Marascuilo (1966) procedure, which allows simultaneous testing of the differences of multiple pairs of proportions in multiple populations.

Results

Pre-COVID-19 results

The analysis of variance of the Australian Census data set, as revised above, reveals some strong statistical relationships between most of the remaining independent variables and the proportion of residents doing home-based work (HBW) — albeit with some small numerical effects. The analysis of variance itself is significant at the 0.001 level, with an R square of 0.460. Heteroskedasticity tests (White, Modified Breusch-Pagan, Breusch-Pagan and F Test) were also all significant at the 0.001 level. The visual examination of a plot of predicted versus standardised residuals shows an evenly distributed cloud of data points, truncated by those cases where HBW is zero.

Of the variables that most closely describe the nature of the SA₁ (the distance to the beach and the population), only the distance to the beach demonstrates a significant relationship with HBW, which increases by a small margin of 0.00007 per cent with each kilometre further from the ocean (note that if we exclude those SA₁ areas where HBW is zero from the analysis, the population has a significant but small negative effect at the 0.05 level, with each unit increase in population associated with a 0.00001 percent decrease in HBW).

Larger, significant, and positive effects are apparent with the socioeconomic variables describing employment, education, age, income and mortgage. One of the most significant HBW relationships is with employment as a manager or professional: for each unit increase in employment as a manager or professional, HBW increases by 17.6 per cent. In comparison, for each unit increase in post-high school education, HBW increases by 5.8 per cent and for each year in median age, HBW increases by 0.02 per cent. The wealth-associated effects are positive, but relatively small, with each unit

increase in median income associated with a 0.005 per cent increase in HBW, and each unit increase in median monthly mortgage repayments associated with a 0.003 increase (Table 3).

Table 3. Parameter estimates, dependent variable: log (Home-based workers (proportion of residents))

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
(Intercept)	-0.1264	0.0147	-8.6173	2.2E-17	-0.1551	-0.0976
Distance to beach (m)	7.3E-07	1.6E-07	4.4965	7.6E-06	4.1E-07	1.0E-06
Population	-5.5E-06	4.5E-06	-1.2307	0.2187	-1.4E-05	3.3E-06
Median income (\$A, 2016 dollars)	4.9E-05	1.0E-05	4.7126	2.7E-06	2.9E-05	7.0E-05
Median hours worked	3.7E-05	0.0004	0.0980	0.9219	-0.0007	0.0008
Median age	0.0019	0.0002	10.9584	1.1E-26	0.0016	0.0023
Median monthly mortgage repayment (\$A, 2016 dollars)	-1.9E-05	3.0E-06	6.1150	1.3E-09	1.3E-05	2.5E-05
Owens home or has mortgage (% of dwellings)	-0.0090	0.0076	-1.1805	0.2380	-0.0239	0.0059
Three-plus bedrooms (% of dwellings)	0.0124	0.0048	2.5891	0.0097	0.0030	0.0218
Post-high school education (% of residents)	0.0579	0.0161	3.5966	0.0003	0.0263	0.0895
Employment managers and professionals (% of workers)	0.1761	0.0373	4.7178	2.7E-06	0.1029	0.2494
Employment sales (% of workers)	-0.0890	0.0540	-1.6480	0.0996	-0.1949	0.0170
Five-year mobility (% of residents) ¹	-0.0341	0.0108	-3.1586	0.0016	-0.0553	-0.0129

¹This variable indicates if all, some, or none of the residents of a household have address in the previous five years changed

The only variable with a significant negative relationship with HBW is the five-year mobility. Each unit increase in five-year mobility (i.e., the proportion of households with residents who have changed address in the previous five years) is associated with a 3.4 per cent decrease in HBW.

Post-COVID-19 results

The first part of the survey included several introductory questions enquiring about the likelihood of continuing to work from home in the future, and the level of satisfaction, benefits and barriers associated with this type of work. The results of the survey point to a very high level of satisfaction associated with working from home.

Approximately 91% of the respondents stated that they were either satisfied or very satisfied with home-based work. Home-based work is also expected to continue, with over 80% of the participants expecting that they will continue this form of work for at least some of their working hours (Table 4).

Table 4. Key benefits and barriers of home-based work

Benefits		Barriers	
Saves time	775	Inadequate workstation at home	268
Allows better work/family balance	687	Poor internet connectivity	244
Increases productivity	650	Social isolation, not mitigated by virtual meetings	193
Saves money	640	Nowhere to meet with a client	164
Helps lead a healthier life	556	Limited space to accommodate work	150
Improves mental health	470	Hard to separate work from private time	132
		No barriers at all	128

Source: City of Gold Coast Council survey, 2020 (multiple responses were available)

The responses indicate that home-based work is undertaken predominantly from detached dwellings (66% of responses), followed by apartments and townhouses (25%). Next, the survey asked about the activities done more often or less often since the residents started to work from home. A set of 22 activities was included in the survey. For each activity, six possible responses were provided in a single-choice option: less often, slightly less often, about the same, slightly more often, more often, and not applicable. In our analysis, the responses “less often” and “slightly less often” were combined, as were “slightly more often” and “more often.” This simplification of responses was considered necessary for the ease of interpretation and implementation of findings into the further policy work of the local council. The results have been analysed with consideration of the location of each respondent, grouped into three types: coastal location, central location and hinterland location (Table 5). This information was obtained through one of the survey questions.

The influence of working from home on the way that the research participants were undertaking their daily activities was most visible in the coastal part of the city, where higher building density and good public transport enable better access to recreation areas, shops, dining venues and services. Here, respondents reported a noticeable increase in visiting local cafés, shopping within their neighbourhoods, choosing to walk or ride a bicycle instead of driving a car, and accessing local open spaces, including more frequent trips to the beach (Figure 2). More frequent interactions with the neighbours were also reported. Somewhat different responses were reported in the central suburbs, where the built form largely includes low density residential neighbourhoods. No visible increase in shopping locally was observed outside of the coastal suburbs. Interactions with the neighbours and a more frequent use of locally

available open spaces were observed in this part of the city. The city’s hinterland areas, located to the west of the Pacific Motorway (M1), are dominated by a high proportion of large rural residential estates. Here, the respondents reported more frequent walking and cycling trips and the frequent use of locally available open spaces. Interestingly, the frequency of shopping locally decreased. Regardless of the location, the survey participants reported an increased frequency of walking and cycling, and a reduced use of vehicles and less frequent trips on the Pacific Motorway, which is the main motorway connecting the city with Brisbane to the north and Sydney to the south.

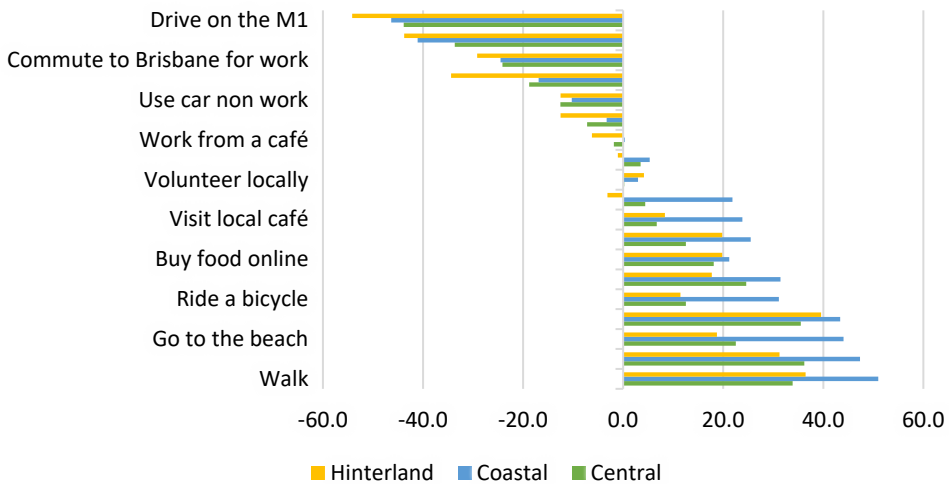


Figure 2. Survey results — impacts of home-based work on daily activities, by location. Source: Home-based work survey (n=887) by City of Gold Coast Council, Oct–Nov 2020

Table 5. Survey results – significant differences, by location

Activities that are not significantly different across the three areas	Driving on the M1, commuting to Brisbane for work, using vehicles during non-workdays, working from a café, working from a co-working space, buying food online, walking kids to school, volunteering locally, interacting with neighbours
Activities where the coastal area is significantly different from the central and hinterland areas	Walking, going to the beach, exercising locally, visiting local cafés, riding a bicycle, using local parks, shopping locally
Activities where the central and hinterland areas are significantly different from each other	Dining locally, shopping locally, using local parks

Source: Home-based work survey (n=887) by City of Gold Coast Council, Oct–Nov 2020

The final part of the survey collected feedback on the future of home-based work in cities. Here, apart from a common plea for better quality internet, survey participants identified several opportunities related to the built environment of their neighbourhoods (Figure 3). These included a need for more co-working spaces in their neighbourhoods. The need for more local places for collaboration and shared work was also echoed in the suggestions to furnish open spaces and parks with enabling infrastructure, including wi-fi, seating and shaded areas. The respondents also pointed to the need for incentives encouraging home-based work and access to training, events and meetings.

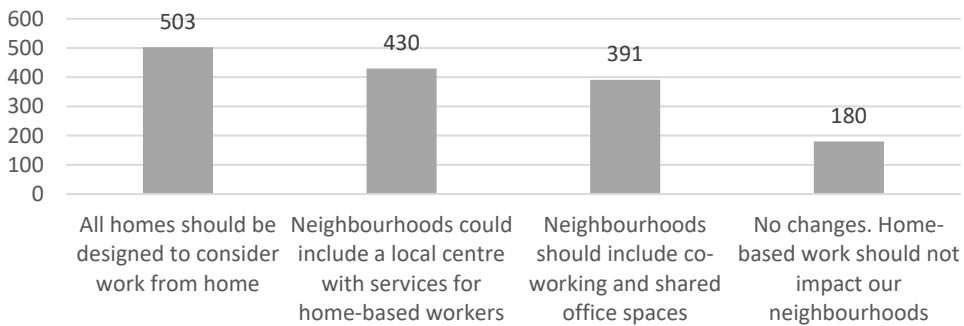


Figure 3. Participants' ideas for the future of home-based work.

Source: City of Gold Coast Council survey (2020)

Discussion

Our 2016 Australian Census analysis points to a significant relationship between the frequency of home-based work and the socio-economic status of neighbourhoods across the City of Gold Coast. It has identified a positive relationship between home-based work and the type of employment, particularly occupations classified as managerial or professional. For each unit increase in the proportion of the residents working as a manager or professional, home-based work increases by 17.6 per cent.

There is also a significant relationship with education, where each unit increase in the proportion of Gold Coast residents with post-high school education, home-based work increases by 95 per cent. As far as the built environment features of the neighbourhoods are concerned, home-based work is associated with larger homes and higher-than-average mortgages, located in well-established areas with low levels of mobility. Home-based work was highly correlated with affluent suburbs often perceived as desirable residential locations, which are either close to the beach or in the rural hinterland. Knowledge work is most suited to home-based work, and it is enabled by higher levels of education and associated with higher incomes. These factors enable the choice of desirable amenity-driven locations.

The results support the notion that attractive amenity-driven destinations, such as the City of Gold Coast in Australia, feature neighbourhood pockets with high proportions of home-based workers. In the City of Gold Coast, these neighbourhoods are concentrated in the affluent beach-side suburbs and in hinterland valleys (Figure 4). Our research provides evidence that these shifts in the city's urban and economic fabric are not evenly distributed but they are the products of desirable neighbourhoods that attract educated and experienced professionals.

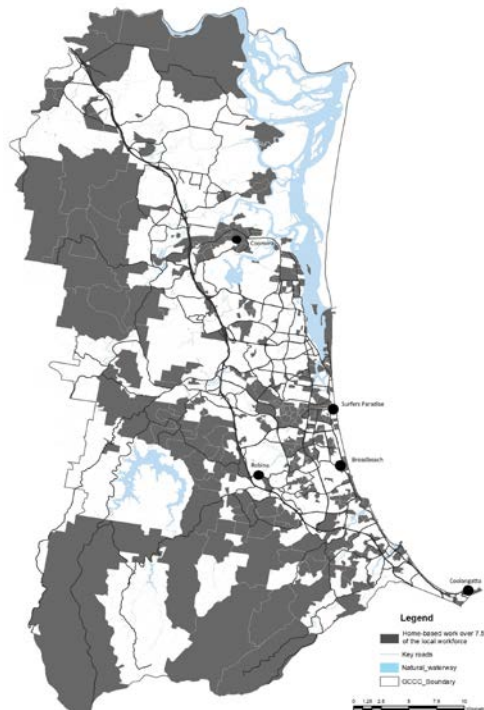


Figure 4. Pre-pandemic distribution of home-based work in the City of Gold Coast

The spatial distribution of home-based workers provides a necessary context for the analysis of potential changes to urban neighbourhoods. The findings of the survey component of our research point to the increased engagement of home-based workers with their neighbourhoods post-COVID-19.

The influence of working from home on the way research participants undertake their daily activities is most visible in the coastal part of the city, which has a higher urban density and better access to recreation areas, shops, dining venues and services. Here, respondents reported a noticeable increase in visiting local cafés, shopping within their neighbourhoods, choosing to walk or ride a bicycle instead of driving a car, and accessing local open spaces, including more frequent trips to the beach. More frequent interactions with the neighbours were also reported.

Slightly different responses were reported in the central part of the city where the built form largely includes low density residential suburbia (the City of the Gold Coast's business districts are spread along the coast, with no dominant CBD). No visible increase in shopping locally was observed; however, the participants pointed to a stronger preference for walking and cycling. Interactions with the neighbours and the more frequent use of locally available open space areas were observed in this part of the city. Lastly, in the city's hinterland, located to the west of the Pacific Motorway, an area dominated by a high proportion of large rural residential estates, the respondents reported more frequent walking and cycling trips and the frequent use of locally available open spaces, but the frequency of shopping locally decreased.

Further, the findings of this research suggest an opportunity, and need, to propose a new way of positioning residential suburbs. Certain residential neighbourhoods will continue to evolve away from being dormitory suburbs towards mixed, or multi-use, where life and work functions occur together, triggering a growth of activity in certain aspects of urban life, such as social interactions, recreation, and access to services. In this context, the planning efforts should focus on exploring whether there is a need to rethink the role of the local neighbourhood centres — many of which continue to be focused on basic services and affordable takeaway meals — as this research suggests that, in the near future, the neighbourhood centres located in pockets of high remote work may become attractive hubs, combining work, shopping and leisure.

Haskel and Westlake (2018) argue that the rise of knowledge work mirrors the rise of private and public investments in intangible capital. That is, relatively speaking, buildings and equipment are now relatively no longer as important to economic development as software, R&D, business processes and creative innovation. The intangibility of these assets makes them more subject to geographical flight, putting pressure on local governments to maintain attractive conditions to avert growth in inequality (Haskel and Westlake 2018).

Our results should also trigger consideration of social divides and growing inequalities within cities, with concomitant issues of gentrification and housing affordability. Many workers do not have the option to undertake work from home, as the nature of their work requires them to attend workplaces, be it industrial establishments, logistics centres or shops. Census data points to a concentration of those workers in certain suburbs, which will continue to perform the role of dormitory suburbs. Further, in the context of recurring waves of COVID-19, those workers will be most vulnerable to and most likely to spread the disease.

Policies fostering home-based work in specific neighbourhoods should be paired up with planning and economic response maximising economic opportunities available for the residents of other urban areas, where home-based work is less likely to emerge. It is yet to be determined to what extent the urban fabric of cities will be impacted by the

increase in home-based work and any associated productivity and creativity of workers. As indicated earlier in this paper, the emerging literature indicates that, in the future, work will be split between the office and home (Bartik et al. 2020, Batty 2020). Should that be the case, this research points to a potential socio-economic challenge at the urban neighbourhood scale. The uneven spatial distribution of jobs that are carried out from home, which was identified and mapped in this paper, highlights the risk of a growing divide between residential areas which, due to the growth of home-based work, will evolve towards being vibrant, multi-use urban environments, and residential areas which, due to the lack of home-based work, will retain their dormitory status.

Conclusions

Cities around the world compete for skilled migrants and economic investment, offering attractive incentives to independent professionals who can bring employment and certain spill-over effects related to higher expenditure in local areas. Due to the growing popularity of flexible and remote work, amenity-driven cities and neighbourhoods are well placed to attract those professionals, as evidenced in our research.

Our paper points to a preference of home-based workers for attractive, prosperous neighbourhoods. These results suggest the necessity for further urban analysis examining employment dynamics in cities, particularly the need to rethink the design of residential neighbourhoods where not just home-based work but also remote, nomadic, and co-working practices are becoming more and more common. As we identified in the literature review, the knowledge economy requires cities to operate as knowledge hubs.

Our research highlights that home-based workers are concentrated in certain areas of the city, yet this spatial proximity per se does not necessarily enable direct contact between them, and therefore additional design interventions, incentives and policies are required to foster the transfer of knowledge and ideas (Casadevall et al. 2018). Further, our paper offers important insight into how people's behaviours, urban interactions and movement patterns change in consequence of undertaking work from home. Importantly, these changes have strong synergies with the built environment aspirations advanced as part of the New Urbanism: our paper finds that home-based workers' preferences for living locally are much stronger in dense, walkable, attractive neighbourhoods. Urban environments shaped in that way appear to benefit from the growth of home-based work resulting from the COVID-19 pandemic. This, on the other hand, raises concerns with respect to the urban divide between the suburbia where the residents do have the option to work from home and the suburbia where workers will continue to commute to work.

This paper has certain limitations, which in turn provide opportunities for further research: it is based on a quantitative analysis of the Australian Census and of survey data. Exploratory methods, such as design charrettes, may be useful to complement the spatially and statistically grounded mapping of data in our analysis. Further limitations relate to the difficulties in measuring the complexity of factors influencing a person's decision to work from home. There is a need to undertake further research in this field, with a particular focus on engagement with home-based and remote workers to measure their impact on their neighbourhoods, as well as their needs and aspirations for their work. Such qualitative data, combined with the type of quantitative analysis presented in this paper, should assist in the formulation of appropriate urban planning and economic strategies in a post-pandemic reality, where home-based work is likely to remain a feature of employment in cities for good. Further work advancing findings of this research should focus on optimising the synergy between the New Urbanism aspirations and the ongoing growth of home-based work. This paper draws attention to the risk of spatial inequalities within cities, which should also be explored further.

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