Dadansoddi ar gyfer Polisi

YMCHWIL GYMDEITHASOL Y LLYWODRAETH

GSR

GOVERNMENT SOCIAL RESEARCH

Analysis for Policy

Llywodraeth Cymru
Welsh Government

SOCIAL RESEARCH NUMBER:
61/2020
PUBLICATION DATE:
02/09/2020

Businesses' perceptions of risk of reduced employee productivity due to higher working temperatures and infrastructure disruption in working environments

Mae'r ddogfen yma hefyd ar gael yn Gymraeg.

This document is also available in Welsh.

 Digital ISBN : **978-1-80082-076-0**

Businesses' perceptions of risk of reduced employee productivity due to higher working temperatures and infrastructure disruption in working environments

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Full Research Report: Marshall, T. & Allies, O. (2020). *Businesses' perceptions of risk of reduced employee productivity due to higher working temperatures and infrastructure disruption in working environments*. Cardiff: Welsh Government, GSR report number 61/2020.>
Available at: https://gov.wales/business-perceptions-risks-due-heat-related-climate-change

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Glossary

Acronym/Keyword/Initialism	Definition
Bu5	UK CCRA “Risks to business from reduced employee productivity, due to infrastructure disruption and higher temperatures in working environments”
CCC	Committee on Climate Change
CCRA	Climate Change Risk Assessment
COVID-19	Coronavirus Disease 2019
CRM	Customer Relationship Management
DEFRA	UK Government Department for Environment, Food and Rural Affairs
SMEs	Small and Medium-Sized Enterprises

1. Introduction/Background

1.1 This report details the findings of research carried out by Wavehill, an independent social and economic research company, on behalf of the Welsh Government. In December 2019, Wavehill was commissioned to carry out a research project engaging with businesses in Wales to identify:

- Businesses' perceptions of the risk of a decline in worker productivity due to infrastructure disruption and higher working temperatures and how it varies between business sizes and business sectors, as well as between manufacturing and office environments.
- Whether or to what extent businesses in Wales have adequate business adaptation plans in place to manage a potential decline in workforce productivity and infrastructure disruption as a result of increased temperatures, and the reasons as to why businesses do not have adequate adaptation plans in place.
- Whether additional support is required in order to aid businesses in developing robust business adaptation plans.

Research Background

1.2 In March 2016, the Welsh Government passed the Environment (Wales) Act.[1] The Act placed a duty on Welsh Ministers to set targets for reducing greenhouse emissions and help build resilience to extreme weather events. This Act built on the framework provided by the Well-being of Future Generations (Wales) Act 2015, which established a resilient Wales as a key well-being goal.[2] Specifically, it identified that Wales must be "a nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change".[3]

[1] Environment (Wales) Act 2016
[2] Well-being of Future Generations (Wales) Act 2015
[3] Well-being of Future Generations (Wales) Act 2015

1.3 In April 2019, the Welsh Government declared a climate emergency. The Welsh Government has committed to achieving a carbon-neutral public sector by 2030 and coordinating action to help other areas of the economy to make a decisive shift away from fossil fuels.

Climate Change Risk Assessment

1.4 The immediate context of this research is the 2017 Climate Change Risk Assessment (CCRA) Evidence Report published by the UK Committee on Climate Change (CCC).[4] The Climate Change Act (2008) requires the UK Government to compile every five years its assessment of the risks and opportunities arising for the UK from climate change. The first UK CCRA was presented to Parliament by the Government in January 2012 and a second CCRA was produced in January 2017. These reports are developed by scientists, governmental departments and other stakeholders across the UK. The reports have sought to answer the following question: "Based on the latest understanding of current, and future, climate risks/opportunities, vulnerability and adaptation, what should the priorities be for the next UK National Adaptation Programme and adaptation programmes of the devolved administrations?"[5]

1.5 Various factors were considered in the CCRAs, including the potential scale and future risks and opportunities, how much action is currently underway and the potential benefit of future action. The report used four 'urgency categories' which were assigned to each risk or opportunity. The 'research priority' category was reserved for those areas in which the risks could be significant but further evidence was required in order to determine the best course of action.

1.6 A Wales National Summary report was produced which contains only the Wales-specific evidence from the UK-level CCRA Evidence Report.[6] The report identified 56 risks for Wales from the impacts of climate change. In response to this, the Welsh Government committed to publishing a new Climate Change Adaptation Plan for Wales. Following stakeholder consultation, the Welsh Government developed

[4] UK Climate Change Risk Assessment 2017 Evidence Report
[5] UK Climate Change Risk Assessment 2017
[6] UK Climate Change Risk Assessment 2017 Evidence Report

the plan, outlining 32 actions to be completed during the five-year lifetime of the plan.[7]

1.7 The Wales National Summary report identified “Risks to businesses from reduced employee productivity, due to infrastructure disruption and higher temperatures in working environments” (classified in the UK CCRA as Bu5) as being a research priority for Wales. Specifically, this report identified that more research was deemed to be necessary on "disruption to ICT, power and transport infrastructure which prevents workers accessing premises or working remotely, and on impacts of higher temperatures on employee safety and productivity”.[8] Within this wider risk category, three current and future risks were identified:

- Infrastructure disruption;
- Higher temperatures; and
- Adaptation.

1.8 When this report was published there was no Wales-specific evidence of any of these risks cited within Bu5. The CCRA stated that research is needed in order to fully understand the “key interdependencies between business and infrastructure, the types of employment at greatest risk [from climate change], and the effectiveness of planned or autonomous adaptation” within Wales.

1.9 There is, however, some evidence of the risks to businesses across the two areas collected at a UK-wide level. This research is summarised below.

Infrastructure disruption

1.10 There is some evidence of the risks to businesses due to infrastructure disruption at a UK-wide level. However, much of this evidence is collected for all infrastructure disruption due to extreme heat, making it broader than the specific focus of this study.

1.11 According to the 2013 Business Continuity Management Survey carried out by the Chartered Management Institute, staff being unable to come into the office due to travel disruption (63% of respondents) and staff being unable to do so due to school

[7] Draft Climate Change Adaptation Plan for Wales
[8] UK Climate Change Risk Assessment 2017 Evidence Report

closures/childcare costs (46%) were the most common impacts of extreme weather upon the organisations surveyed.[9] This included disruption due to all extreme weather events.

1.12 There is also evidence of the drivers of infrastructure disruption due to climate change, although (again) this is not limited to heat-related events. Research produced by the National Environmental Research Council (NERC) in 2015 identified four key risks of infrastructure disruption due to climate change:

- Infrastructure in the UK experiences significant impacts as a result of the natural variability of our climate
- Increases in the frequency of severe weather events (e.g. flooding) will lead to increased disruption of infrastructure
- Gradual shifts in long-term trends (e.g. a rise in average temperatures) can reduce the capacity or efficiency of some infrastructure
- These increases and shifts can alter not just the design life of infrastructure but also the effectiveness of the services it provides.[10]

These effects will be exacerbated by the pressures of projected population growth and ageing infrastructure.[11]

1.13 Infrastructure risk is particularly difficult to model accurately, however, due to the (increasing) dependencies of critical infrastructures upon one another (Dawson et al., 2018). All UK infrastructure sectors have identified failure of another infrastructure sector as being a risk to their own networks. Despite efforts in recent years to encourage infrastructure operators to work together and address vulnerabilities, there is no formalised framework for understanding dependency risks in the UK.[12]

1.14 In the context of these limitations, however, useful work can be undertaken to identify specific dependency risks for sectors within a local context. The UK Government's 'The National Adaptation Programme and the Third Strategy for

[9] The 2013 Business Continuity Management Survey
[10] Infrastructure Climate Change Impacts
[11] Chapter 4: Infrastructure
[12] Chapter 4: Infrastructure

Climate Adaptation Reporting' identified a need to understand "key interdependencies between business and infrastructure, the types of employment at greatest risk [from climate change], and the effectiveness of planned or autonomous adaptation".[13] In addition, the document identified a need to collect business productivity information on productivity and extreme weather events. Understanding these interdependencies can help to inform adaptation on a single firm level, as well as informing systemic adaptation and infrastructure resilience strategies.

1.15 Research conducted at a UK level has also looked into the risk of major IT disruption. Baglee et al. (2012) considered this to be low for larger businesses, but higher for smaller companies (particularly those in remote areas). This research found that certain industries, such as agriculture and construction, employ a larger number of homeworkers. It is currently unclear as to how homeworkers may be affected by IT disruption. Projections of future impact on infrastructure productivity in Wales are not currently available.

Higher temperatures in working environments

1.16 The Wales National Summary reported that at a UK level, the 2003 heatwave was estimated to have resulted in a loss in manufacturing output of £400–500 million; it is unclear as to how much of this was a result of reduced worker productivity.[14]

[13] The National Adaptation Programme and the Third Strategy for Climate Adaptation Reporting
[14] UK Climate Change Risk Assessment 2017 Evidence Report

1.17 This report proceeded to suggest that individuals who work outside, such as those who work in agriculture or construction, are the group most likely to be impacted by higher temperatures. Employees working in certain office types, such as those built in the 1960s or 1970s, buildings with single glazing and poor ventilation, could also be at risk of reduced productivity from higher temperatures.

1.18 At the UK level, the UK CCRA Report suggested future impacts of higher temperatures in working environments impacting productivity. The upper-bound results suggested that the cost of the loss in productivity due to building temperatures could increase from a baseline of £770 million in 2010 to between £850 million and £1.6 billion in the 2020s.[15] There is no equivalent report here covering specific impacts in Wales.

Adaptation

1.19 A business adaptation plan with regard to climate change is a strategy that businesses put in place containing actions to be implemented in order to mitigate the negative effects of climate change upon workplace productivity. It is unclear as to how many businesses in Wales have business adaptation plans, as well as how many public sector or third sector organisations have adaptation plans in place.

1.20 On a UK level, the CCC report suggested that between 2008 and 2013 the proportion of private sector organisations which had business adaptation plans in place increased from 42% to 58%. Extreme weather was the most commonly cited reason for activating an adaptation plan.

1.21 A report was produced in 2013 by Leeds University, which was commissioned by the Department for Environment, Food and Rural Affairs (DEFRA), to inform the UK Government's National Adaptation Plan.[16] One of the aims of this research was to understand the changing need of businesses with regard to climate change and assess what helps and what hinders the development of adaptive capacity. The research surveyed 1,700 businesses.

[15] UK Climate Change Risk Assessment 2017 Evidence Report Summary for England
[16] Programme of research on preparedness, adaptation and risk (PREPARE)

1.22 This report found that 38% of interviewed businesses in the UK were taking action on climate change.[17] However, many organisations were not capable of identifying climate change impacts that could potentially affect them in the future and then incorporating those risks into their decision-making processes. Potential barriers identified in the report as preventing businesses from putting in place plans to manage the potential impacts of a changing climate included a lack of crucial tools, knowledge and expertise.[18] Meanwhile, another potential barrier is that businesses see the risks from climate change as being acute events (e.g. a flood event or heatwave), whereas there is a permanency to climate change which is not always appreciated.

The Need for the Research

1.23 The context of the research, therefore, is the need to produce a specific evidence base for Wales. This evidence base is required for the Welsh Government to assess Welsh businesses' perceptions of the risks due to climate change, as well as their preparedness in meeting these risks. Furthermore, there is a need to explore sectoral differences in perceptions of risk and preparedness, in addition to differences by region, building age and tenure, and size of business.

1.24 The research is also necessary in order to help the Welsh Government to identify support priorities for businesses in Wales. This includes areas of support upon which to focus, as well as who is best placed to deliver such support, and how best to engage businesses so as to encourage them to develop climate change adaptation plans.

[17] Programme of research on preparedness, adaptation and risk (PREPARE)
[18] Programme of research on preparedness, adaptation and risk (PREPARE)

2. Methodology

2.1 In order to develop an evidence base for analysis, primary data was collected from businesses, third sector organisations and some public sector organisations across Wales.

2.2 Research was carried out through two main research methods, i.e. a business survey conducted online and via telephone, and in-depth follow-up interviews with businesses via telephone.

Business survey

2.3 The primary mode of data collection was a business survey conducted both online and via telephone. The survey was developed in consultation with the Welsh Government to ensure that questions probed the issues upon which the Welsh Government wished to focus.

2.4 The survey was distributed using four main methods. It was decided that this would maximise survey responses during the relatively short timeframe available for the research. A total of 243 responses were received across the four methods:

- Included as an item in the Business Wales newsletter (0–55 completed responses);[19]
- Through Business Wales CRM using initial email engagement and two follow-up emails (0–55 completed responses);[20]
- Via a panel of business representatives in Wales obtained via Qualtrics (155 completed responses);[21]
- Through telephone interviews with contacts purchased from the consumer reporting agency Experian (33 completed responses).

2.5 Both the initial emails (to engage businesses) and the follow-up emails (to prompt businesses to participate in the research) were provided in both Welsh and English.

[19] It is not possible to report the exact number of businesses that were engaged through the Business Wales newsletter and the number that were engaged via the Business Wales CRM.
[20] Businesses that have received advice and support from Business Wales are added to a CRM and their contact details are retained.
[21] Qualtrics is the survey software that was used to host the business survey. Qualtrics also hosts a number of 'panels', which allow a survey to be distributed to a select demographic. Businesses in Wales that meet the criteria established in the sample frame on Qualtrics' business panel were invited to participate in the survey.

Regardless of the mode of delivery, the survey asked the same questions and was available bilingually. A copy of the survey has been included in Annexe A of this report.

2.6 A sampling frame was developed in order to ensure that the businesses engaged through the survey reflected research priorities and business demographics in Wales. The sampling frame was developed based on a combination of the size of this sector within the Welsh business community, those sectors that were considered most exposed to issues associated with climate change, and those in which potential policy interventions could have the greatest effect. The sample frame was used to request contact details from Experian and select businesses for the Qualtrics panel.

2.7 Reflecting the priorities of the project, the sampling frame considered the business size and sector. The sample focused on small (10 to 49 employees) and medium-sized businesses (50 to 249 employees) in sectors which were likely to have office-based, manufacturing or outdoor workers and in which Welsh Government adaptation efforts were likely to have most benefit. A copy of the sampling frame has been included as Annexe B of this report.

2.8 The survey was in the field between 2nd March and 25th March 2020. Initially, a target of 350 responses was pursued. Following disruption due to the outbreak of COVID-19, however, many businesses were closed, and others were unable to participate in the research because they were taking measures to adapt their operations in order to deal with the emergency. As a result, and reflecting a desire to be sensitive to the way in which the Welsh Government engages with the business community in difficult times, the survey was removed from the field earlier than anticipated, with 243 responses received at the time of closure. This resulted in the distribution of businesses that was initially pursued not being achieved. Although the sample is broadly representative of the business population in Wales, the particular sectoral focuses within the sample frame were not met.

In-depth interviews

2.9 In addition to the business survey, 10 in-depth follow-up interviews were carried out via telephone. Businesses which had completed the initial survey were asked whether they would be happy to participate in follow-up research. Of those which stated that they were willing to engage in further research, a selection were contacted. Businesses were chosen for follow-up which reflected a range of business sizes. The follow-up interview was available in both English and Welsh. The purpose of these interviews was to generate more detailed evidence regarding what businesses have done to mitigate risks to productivity due to higher working temperatures and infrastructure disruption. In addition to this, it was anticipated that these in-depth interviews would act as the basis for case studies highlighting the way in which businesses have adapted in order to mitigate the risks identified in the research. These follow-up interviewees were to be recruited via the survey.

2.10 Once initial survey responses had been assessed, however, it was discovered that fewer businesses had adaptation plans in place than initially anticipated, particularly among those who agreed to participate in follow-up interviews. Therefore, it was decided to broaden the focus of these interviews so as to also address barriers preventing businesses from drawing up adaptation plans. Discussion guides for these in-depth interviews have been included in Annexe A of this report.

2.11 Initially, it was anticipated that 20 of these interviews would be completed. As with the business survey, however, these interviews were disrupted by the outbreak of COVID-19 — only 10 interviews were completed. Fewer businesses with climate change adaptation plans than anticipated participated in the interviews and where they did, there was insufficient information to produce case studies that would be replicable for other businesses. On this basis, the decision was made not to publish these case studies.

Limitations of the Research

2.12 As noted above, the primary limitation of the research is that the final number of survey responses obtained is smaller than the target number of responses. The target responses were not reached before the data collection was closed. This was due to disruption resulting from COVID-19. Social distancing measures which came into effect on 23rd March 2020 meant that many businesses were no longer working on site, and others were unable to respond due to pressures presented by the social distancing measures. In this context, it was decided to close the data collection early.

2.13 This causes potential problems regarding the robustness of the findings. The data collected is broadly representative of the Welsh business population, and the sectors upon which the sample frame focused are well represented. Due to the small sample size, however, it is problematic to draw conclusions when data is disaggregated by sector or region. Therefore, caution must be exercised when drawing conclusions on differences between segments within the data.

2.14 Due to the small sample size, statistical testing of the results has not been carried out. It should therefore be understood that where the report comments on differences being apparent, these differences are indicative rather than statistically significant.

2.15 A secondary limitation of the research is that the data collected is of variable quality. The focus of the research has been upon perceptions of risks to business continuity and the mitigation of risks, but it is not clear that businesses have always understood the precise nuances of the research questions. For example, some responses to the survey suggest confusion surrounding the difference between climate change mitigation and climate change adaptation issues. As will be discussed later in the report, this is an issue with which many businesses are not familiar discussing, which may have affected the quality of the data collected.

2.16 Issues surrounding the consistency and coherence of the data were particularly prominent among responses collected via the Business Wales email, Business Wales CRM and the Qualtrics panel. This is because telephone interviewers were able to explain the context of the questions and remind participants of the distinction between climate change mitigation and climate change adaptation. Surveys delivered online relied more on respondents' interpretation of the questions. The quality of the data collected online potentially reflects the limitations of this mode of data collection, where the context of the research is complex or unfamiliar for businesses.

2.17 There is the potential for sampling bias. Businesses without the time and resources with which to plan for climate change may have been less likely to participate in research than businesses who did engage in adaptation activities. Moreover, it is likely that business representatives that were particularly engaged with climate change were more likely to engage with the research than were those that were not.

3. Businesses' Perceptions of Risks

3.1 This chapter outlines the research findings regarding businesses' perceptions of the risks to business productivity due to higher working temperatures and infrastructure. disruption.

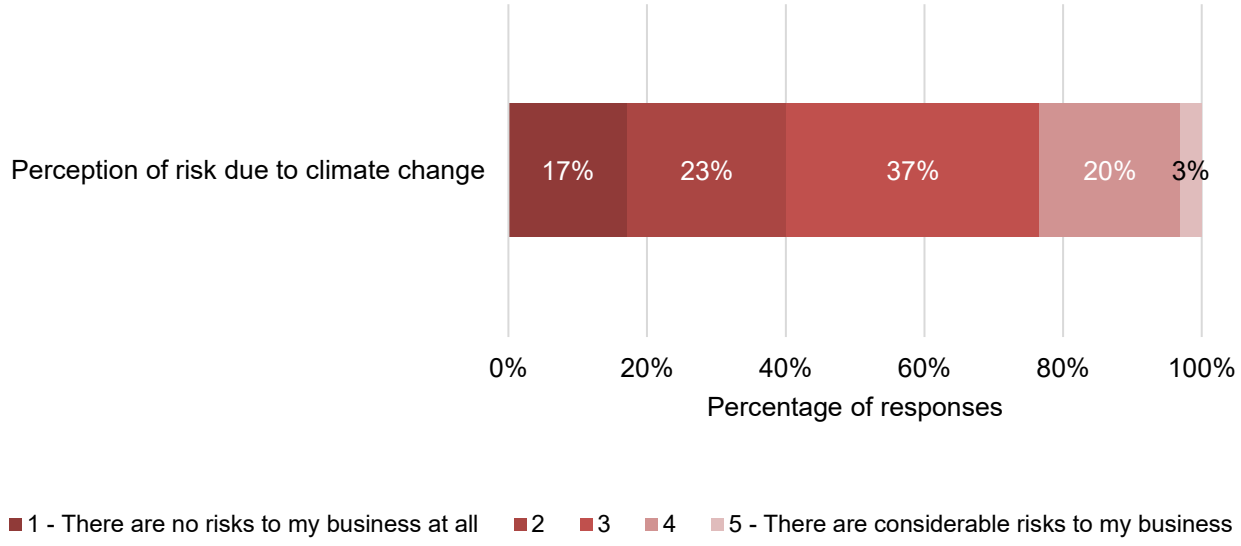
Key points:

- While many businesses in Wales are thinking about the ways in which these risks may affect them, assessing and mitigating these risks is not a pressing priority for many of them.
- It is notable that a small but significant minority of businesses which engaged in the research do not perceive any risks to their business due to climate change (17%, 33/227), and others, while perceiving risks due to climate change, do not perceive risks in either of the two areas upon which this study has focused.
- While many businesses are concerned about potential risks, they are unclear as to what the actual risks are, including specific sectoral risks.

Overall Perceptions of Risk Due to Climate Change

3.2 As an introductory question, businesses were asked to assess the risks to their business due to climate change on a scale of 1–5 (where 1 = 'not at all' and 5 = 'to a great extent'). Responses to this question were varied, clustered around a mean score of 2.69, and slightly skewed towards the bottom of the scale. A large number (17%, 33/227) of businesses surveyed identified no risks at all to their business due to climate change. Relatively few (only 3%, 7/227) respondents identified the highest risk factor for their business as being climate change.

Figure 3.1: **To what extent do you believe your business is at risk from the effects of climate change? (where 1 = 'not at all' and 5 = 'to a great extent')**



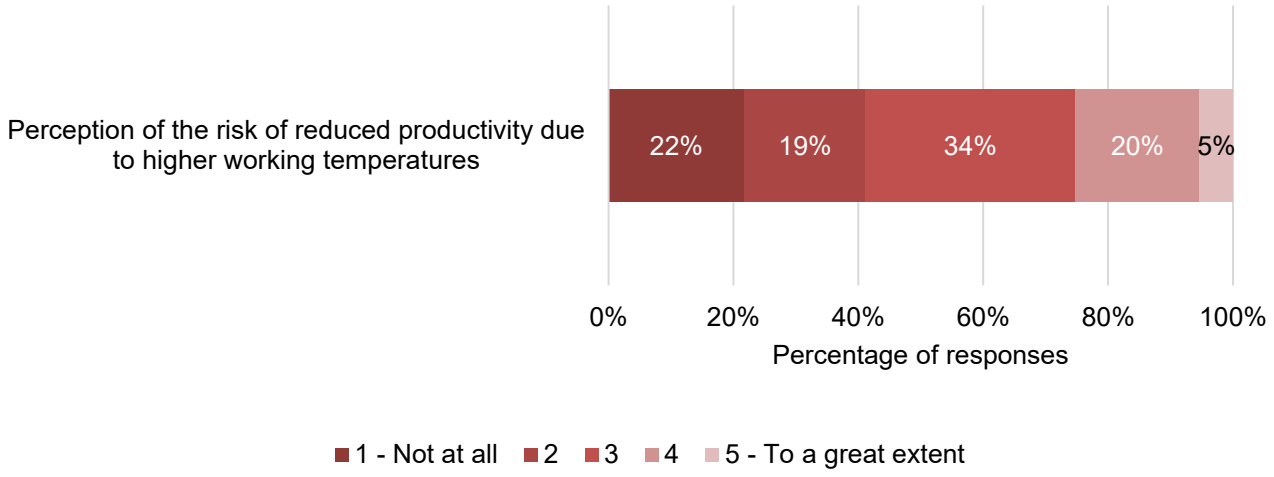
N=227

Source: Business survey

Risks Due to Reduced Productivity as a Result of Higher Working Temperatures

3.3 Businesses that identified any risks due to climate change were asked follow-up questions on specific risks associated with climate change. The first additional area probed by the survey was reduced productivity due to increased working temperatures. As with general risk due to climate change, businesses were asked to assess the risks to their business due to climate change on a scale of 1–5 (where 1 = 'not at all' and 5 = 'to a great extent'). A range of responses were received, clustered around a mean score of 2.68, as demonstrated in Figure 3.2 below.

Figure 3.2: To what extent do you believe your business is at risk of reduced productivity due to increased working temperatures? (1 = 'not at all' and 5 = 'to a great extent')



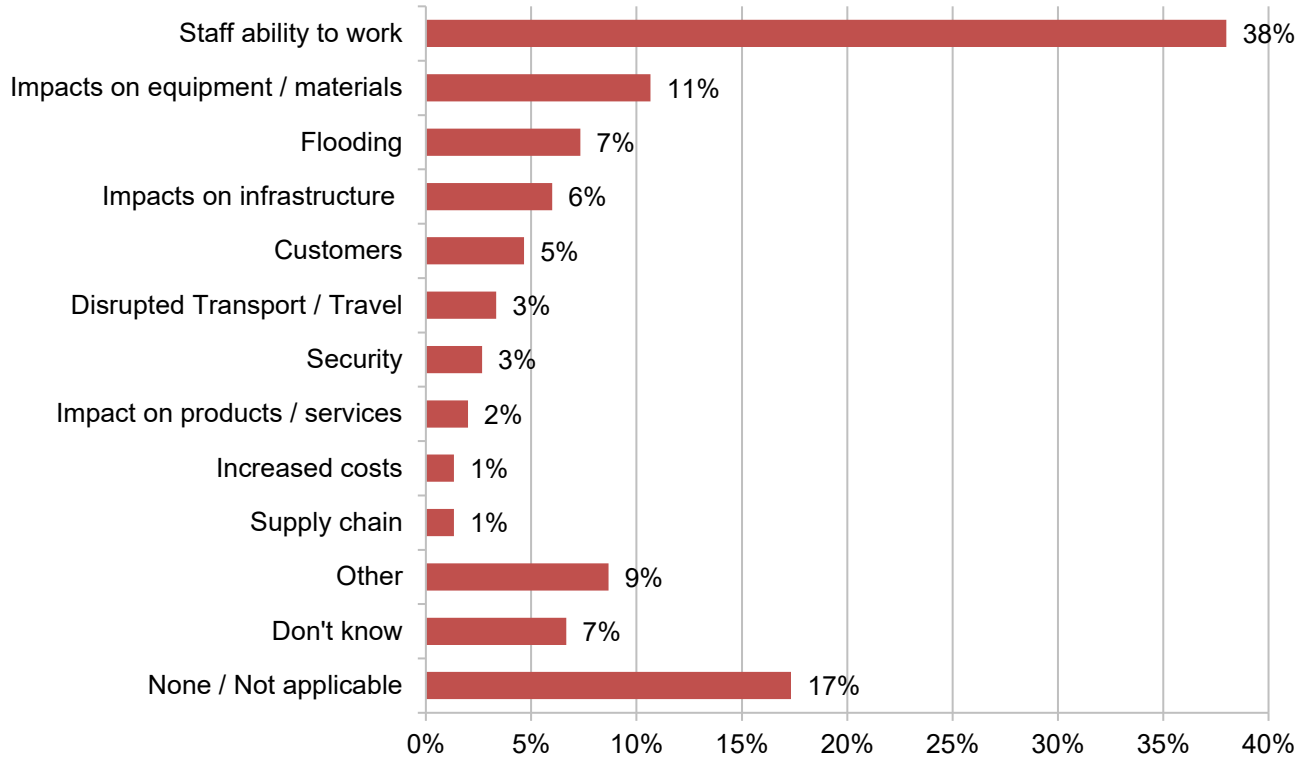
N=170

Source: Business survey

3.4 Of these responses, only 5% (9/170) of businesses identifying risks to their business from climate change identified the highest level of risk as constituting risks to business productivity due to higher working temperatures (4% of all businesses surveyed, 9/242). Additionally, 22% (37/170) of respondents to this question identified no risks to their business in this area. When businesses that identified no risks at all due to climate change are added, this creates a total of 31% of businesses identifying no risks to their business in this area.

3.5 Businesses were also asked to explain their perceptions of the risk of higher working temperatures. As Figure 3.3 indicates, the primary risk identified by businesses is staff's ability to work (38%, 57/150). A notable secondary impact identified was the risk to machinery due to higher working temperatures (11%, 19/150).

Figure 3.3: Please explain what risks you perceive there to be to productivity due to increased working temperatures (code)



N=170

Source: Business survey

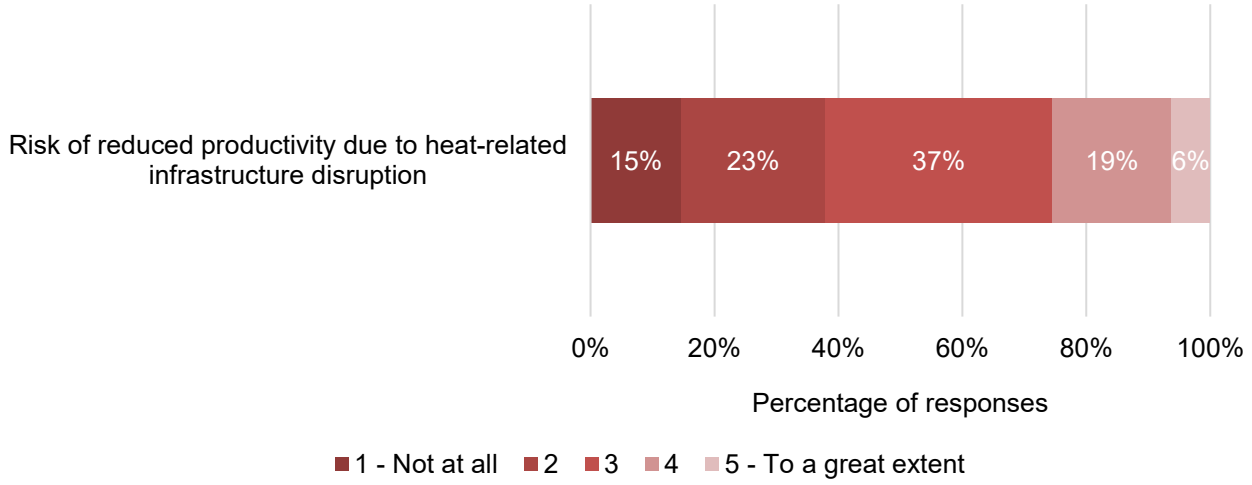
3.6 In addition to the specific risks identified above, data collected from open-ended questions in the business survey indicates that many businesses are unsure as to what risks businesses in Wales face from climate change. Some businesses responding to this question also reported that they do not feel that they have sufficient information on how climate change will affect specific sectors to answer this question. Although businesses responded to questions on perceptions of risk, the fact that many also reported that there is much uncertainty may indicate that the appraisals of risk collected in this research are not based on accurate understandings of how exposed to risk businesses actually are.

Risks Due to Infrastructure Disruption

3.7 The second area of risk probed by the survey was reduced productivity due to infrastructure disruption. Again, a scale of 1–5 was used (where 1 = ‘not at all’ and 5 = ‘to a great extent’). A range of responses were received, clustered around a mean

score of 2.79. Notably, as Figure 3.4 indicates, only 6% (11/177) of respondents to this question perceive their business to be at great risk of reduced productivity due to infrastructure disruption resulting from increased temperatures. Of all respondents to this question, 15% (26/177) identified no risks to their business due to infrastructure disruption (27% of all survey respondents identified no risks in this area).

Figure 3.4: To what extent do you believe your business is at risk of reduced productivity due to infrastructure disruption (e.g. road/rail disruption, power outages or disrupted internet connection) as a result of increased temperatures? (where 1 = 'not at all' and 5 = 'to a great extent')



N=177

Source: Business survey

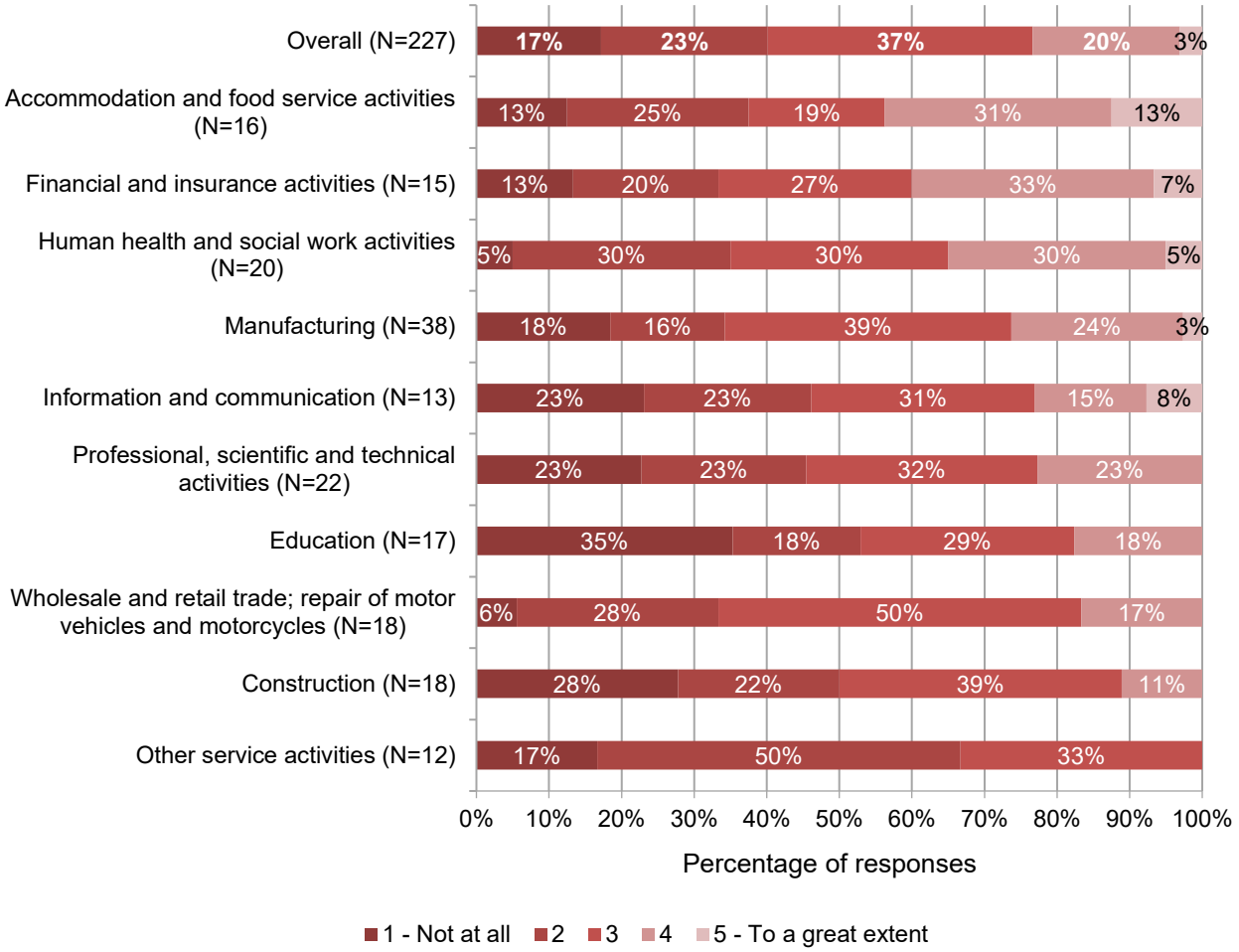
Sectoral Differences in Perceptions of Risk

3.8 Reflecting research carried out elsewhere,[22] it was hypothesised that there may be greater perceptions of risk within the sectors most exposed to these risks. In particular, it was suggested that sectors in which employees are required to work outdoors, such as agriculture and construction, or businesses in which working temperatures are high anyway, such as kitchens or some manufacturing environments, might perceive greater risks of reduced productivity due to higher working temperatures. Likewise, it was anticipated that industries that are particularly reliant on infrastructure, such as the information and communication sector, might perceive particular risks in relation to infrastructure disruption. However, the data collected suggests that there is not a clear relationship between exposure to risk and perception of risk, although the overall low survey response rate means that the findings should be treated with caution.

3.9 As Figure 3.5 indicates, there was a small variation between sectors but there is no evidence of statistically significant differences in perceptions of risk due to climate change. Accommodation and food service businesses identified the highest risk due to climate change, followed by financial and insurance activities and human health and social work activities. Notably, construction businesses responding to the survey perceived lower-than-average risks to their business resulting from climate change. Conversely, financial and insurance activities businesses demonstrated above-average perceptions of risk.

[22] See for example: Arnell, N.W., Brown, S., Gosling, S.N. et al. The impacts of climate change across the globe: A multi-sectoral assessment. Climatic Change 134, 457–474 (2016).

Figure 3.5: To what extent do you believe your business is at risk from the effects of climate change? (where 1 = 'not at all' and 5 = 'to a great extent')

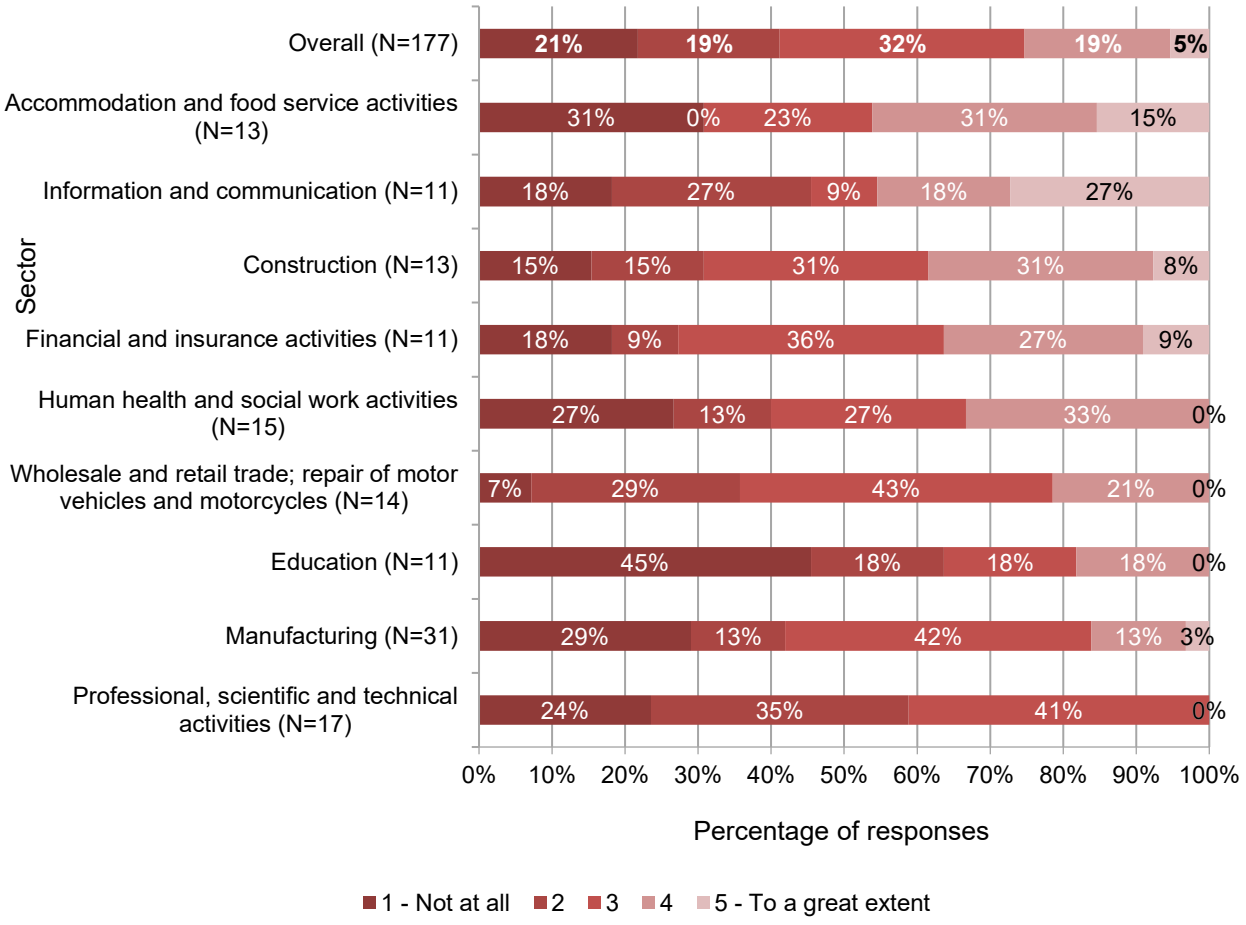


N=225

Source: Business survey

3.10 As was anticipated, construction and accommodation and food service activities perceived a higher-than-average risk of reduced productivity due to higher working temperatures. Consistent with the overall perceptions of risk due to climate change, businesses in the financial and insurance activities sector perceived above-average levels of risk due to higher working temperatures. Notably, information and communication businesses perceived the highest level of risk in this area, although responses to the open-ended questions perhaps indicate that this is due to the perception of risks to machinery due to higher working temperatures. Equally notable is that manufacturing businesses reported a below-average perception of risk in this area.

Figure 3.6: To what extent do you believe your business is at risk of reduced productivity due to higher working temperatures? (where 1 = 'not at all' and 5 = 'to a great extent')

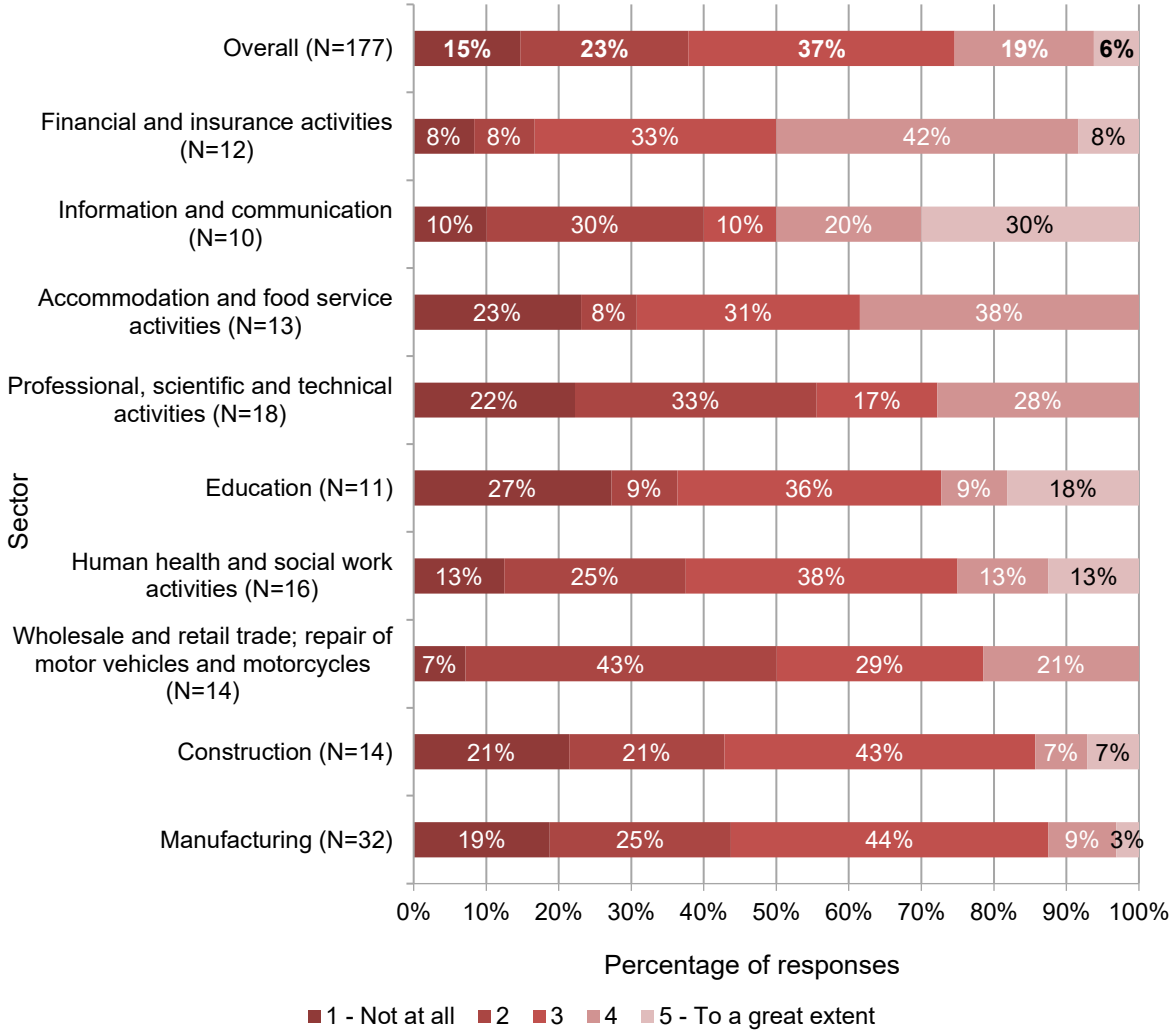


N=177

Source: Business survey

3.11 Finally, sectoral disaggregation of results demonstrates that financial and insurance businesses surveyed perceive the greatest risk of reduced productivity to be infrastructure disruption. Again, information and communication businesses perceived above-average levels of risk, as anticipated prior to the research. Both construction and manufacturing businesses, however, identified below-average levels of risk in this area.

Figure 3.7: To what extent do you believe your business is at risk of reduced productivity due to infrastructure disruption (e.g. road/rail disruption, power outages or disrupted internet connection) as a result of increased temperatures? (1 = 'not at all' and 5 = 'to a great extent')



N=177

Source: Business survey

3.12 There does not appear to be a clear correlation between those sectors potentially at most risk and perceptions of risk. For example, manufacturing businesses consistently identified less-than-average risks across the whole sample, despite these businesses' comparatively higher exposure to risks in these areas. Conversely, financial and insurance activities consistently identified higher-than-

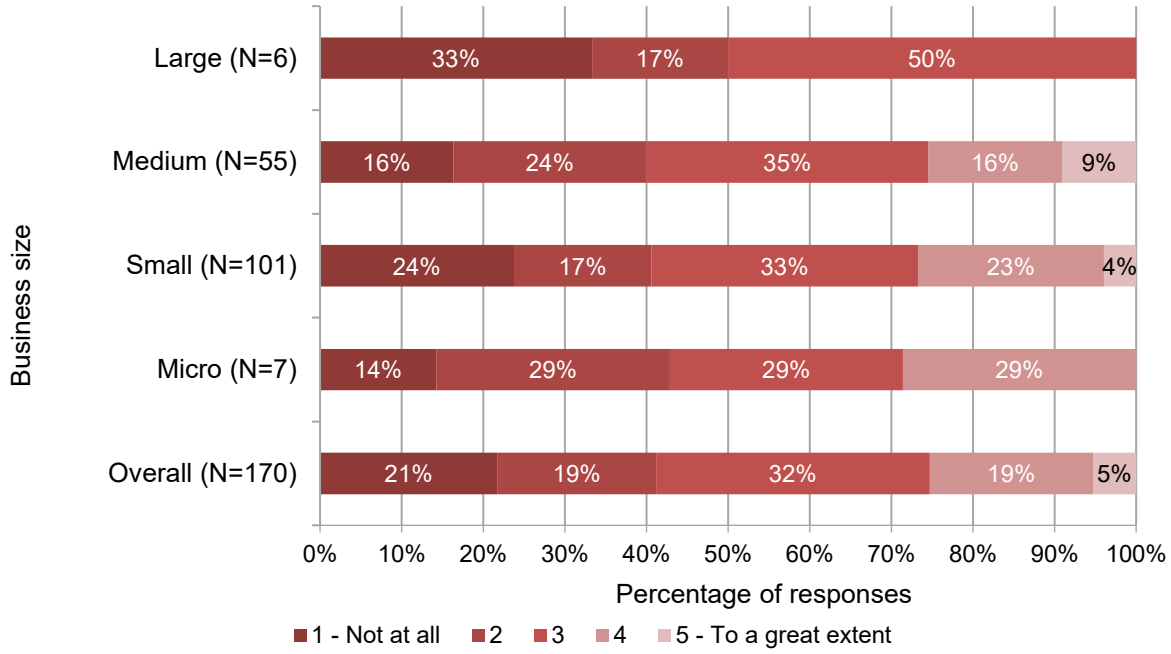
average risks across all three risk areas, despite less exposure than that of some other businesses.

3.13 One explanation that the authors propose for the relatively high perception of risk among financial and insurance activities is that businesses' existing approaches to assessing and mitigating risks may be potential drivers of perceptions of risk. The relatively small amount of data collected in this research, however, suggests that these conclusions must be treated with caution.

Perceived Risks Disaggregated by Size

3.14 As demonstrated in Figures 3.8 and 3.9 below, there are no major differences in perceptions of risk when the findings are disaggregated by business size.

Figure 3.8: To what extent do you believe your business is at risk of reduced productivity due to increased working temperatures? (where 1 = 'not at all' and 5 = 'to a great extent') (by size)



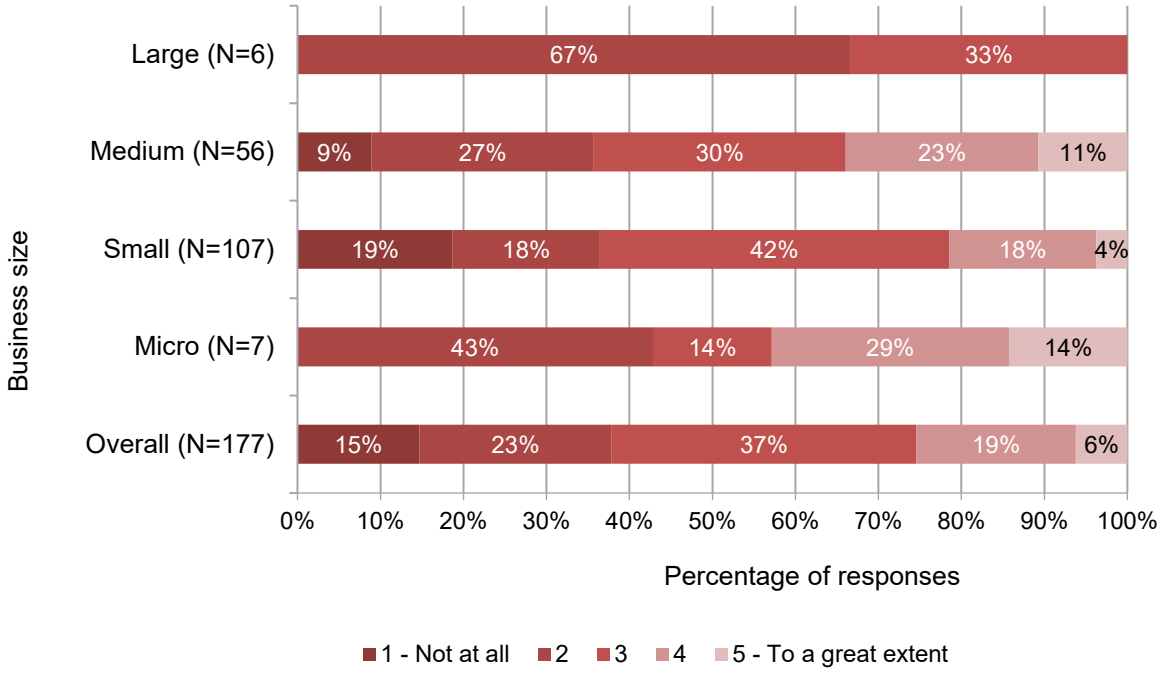
N=169

Source: Business survey

3.15 The large businesses that responded to the survey identified less risk in each of these areas than did micro, small or medium-sized businesses. This potentially indicates greater confidence than that of smaller businesses in being able to adapt

their business. Again, the sample size for micro and large businesses is small (seven and six respectively); thus, caution must be exercised in drawing conclusions based on this data.

Figure 3.9: To what extent do you believe your business is at risk of reduced productivity due to infrastructure disruption (e.g. road/rail disruption, power outages or disrupted internet connection) as a result of increased temperatures? (where 1 = 'not at all' and 5 = 'to a great extent')



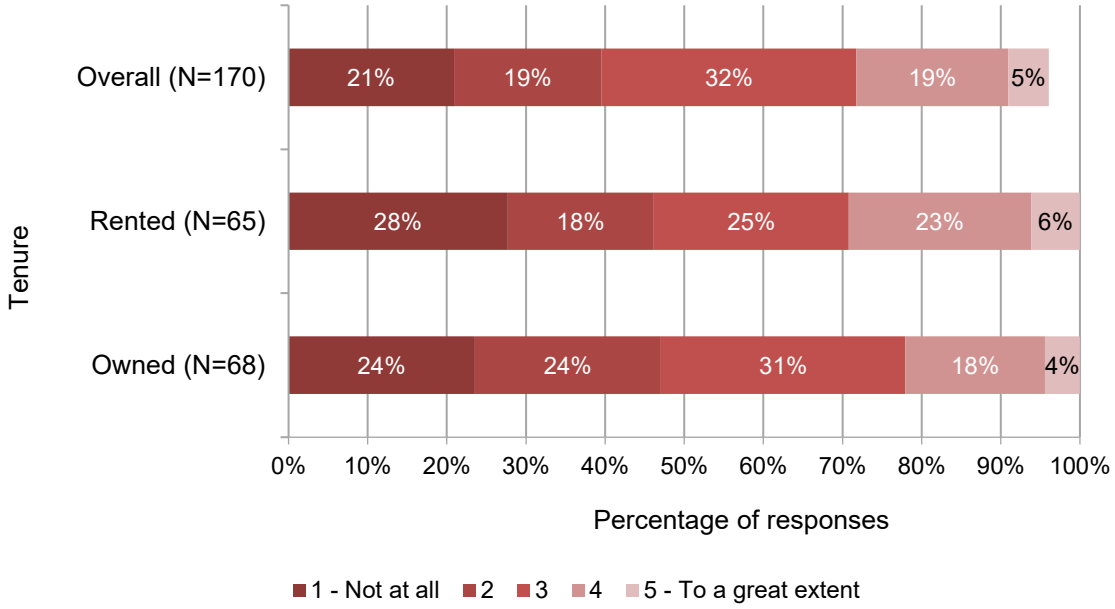
N=176

Source: Business survey

Perceived Risks Disaggregated by Tenure

3.16 Tenure was taken as another potential variable affecting businesses' perceptions of risk. This was explored because it was hypothesised that businesses in rented properties may find it more difficult than businesses in owned premises to make changes to premises in order to adapt to higher temperatures and, therefore, perceive a higher risk. When data is disaggregated by tenure, however, there does not appear to be a large difference in how businesses perceive the risk of reduced productivity due to working temperatures, as demonstrated by Figure 3.10 below.

Figure 3.10: To what extent do you believe your business is at risk of reduced productivity due to increased working temperatures? (where 1 = 'not at all' and 5 = 'to a great extent') (by tenure)

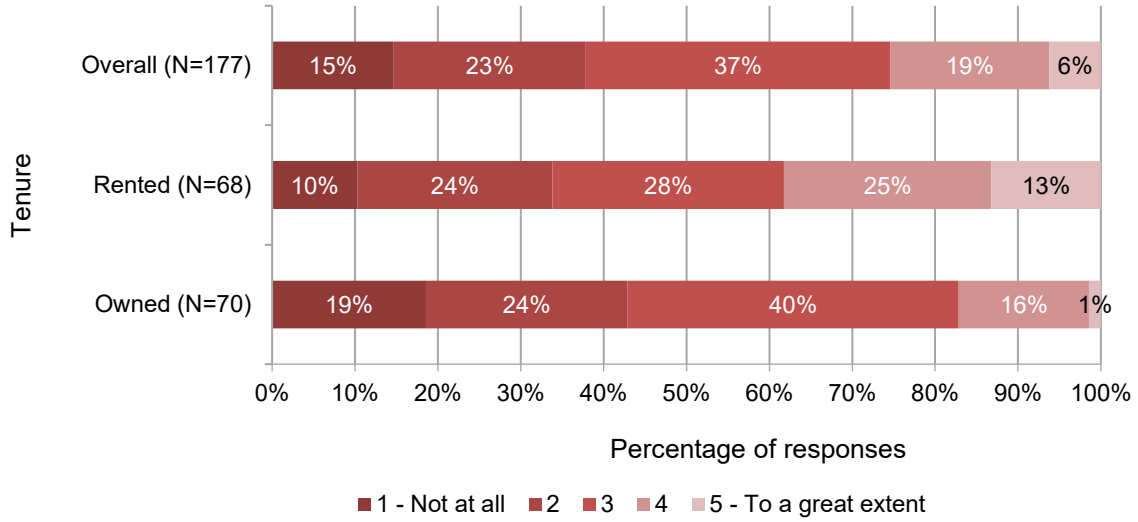


N=133

Source: Business survey

3.17 There is a larger difference, however, between rented and owned premises in perceived risks due to infrastructure disruption. As Figure 3.11 indicates, businesses in rented premises are more likely to identify risks due to infrastructure disruption than are businesses in owned premises.

Figure 3.11: To what extent do you believe your business is at risk of reduced productivity due to infrastructure disruption (e.g. road/rail disruption, power outages or disrupted internet connection) as a result of increased temperatures? (where 1 = 'not at all' and 5 = 'to a great extent') (by tenure)



N=138

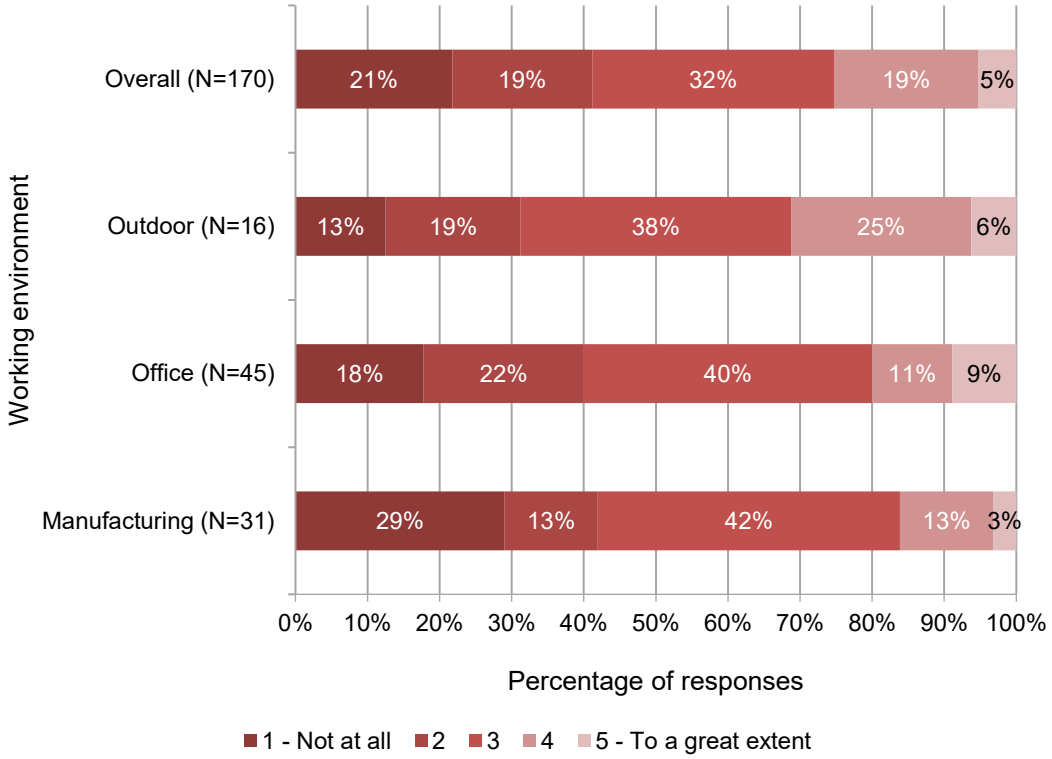
Source: Business survey

Perceived Risks Disaggregated by Working Environment

3.18 Another priority for this research has been to understand differences between businesses' perceptions of risk across different working environments. Specifically, the research has explored whether there are differences — regarding perceptions of risk to productivity due to higher working temperatures — between office environments, manufacturing environments, and businesses in which the majority of employees work outdoors.

3.19 As Figure 3.12 demonstrates, businesses whose employees work outdoors perceive the biggest risk of productivity disruption due to increased working temperatures. Office-based businesses also reported perceiving above-average risks due to higher working temperatures, while businesses whose employees work in manufacturing environments reported below-average risks due to higher working temperatures.

Figure 3.12: To what extent do you believe your business is at risk of reduced productivity due to increased working temperatures? (1 = 'not at all' and 5 = 'to a great extent') (by mode of work)



N=170

Source: Business survey

Additional Analysis of Perceptions of Risk

3.20 In addition to the factors assessed above, additional analysis was carried out in order to identify any other potential differences in perceptions of risk. Additional factors, including building age, location of headquarters, and number of sites, were analysed. However, no relationship between these factors and perceptions of risk was found by this analysis. These findings have been included in Annexe C of this report.

4. Businesses' Approaches to Assessing and Acting on Risks

4.1 This chapter outlines the findings of this research regarding the way in which businesses have assessed and acted on the heat-related risks posed by climate change.

Key points:

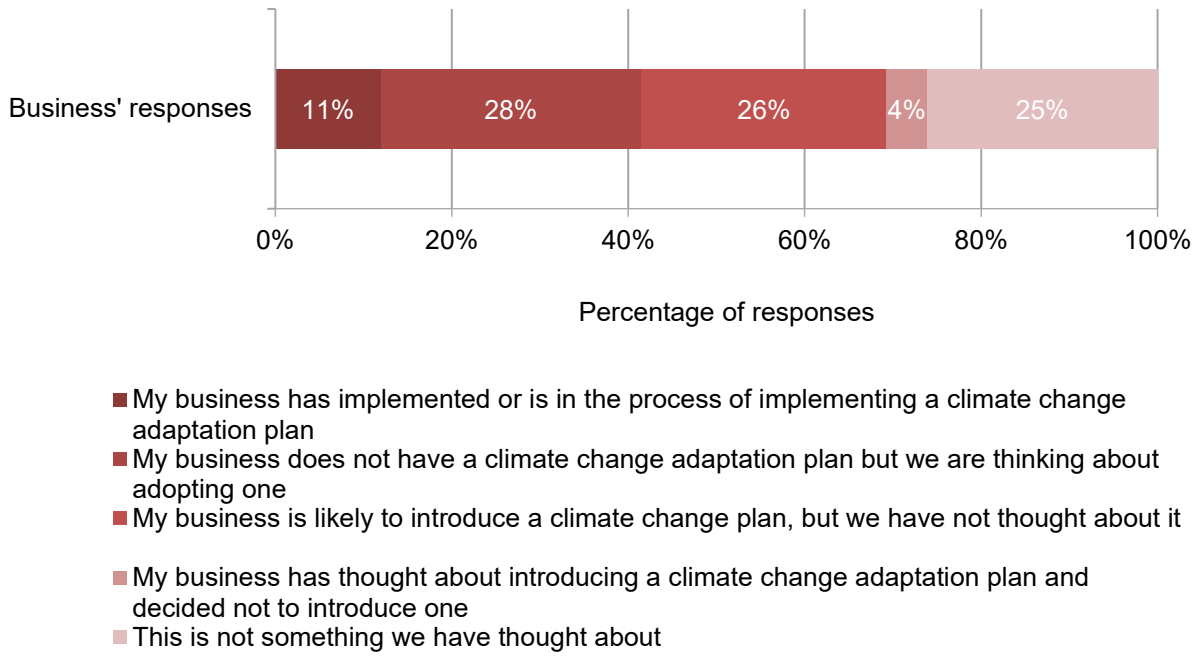
- Although businesses do perceive there to be risks resulting from climate change, including heat-related risks such as higher working temperatures and infrastructure disruption, relatively few are taking action in order to fully understand and mitigate these risks.
- Most businesses responding to the survey expressed an intention to act to adapt to the risks posed by climate change, but the majority have not yet taken action. A significant number of businesses (54%, 101/185) reported an interest in adopting a climate change adaptation plan but have not yet done so.
- Only 11% (21/185) of businesses responding to the survey have implemented or are in the process of implementing a climate change adaptation plan.

4.2 In addition to perceptions of risk, the survey asked businesses about the steps that they had taken to assess and mitigate risks due to higher working temperatures and infrastructure disruption. All businesses were asked an initial filtering question on their approach to assessing and mitigating risks. Businesses that identified risks due to climate change were asked subsequent questions on how they assessed and mitigated the risks.

4.3 The data indicates that across the sample as a whole, while there is some intention to act on climate change adaptation, action has generally not been taken. As Figure 4.1 indicates, only 11% (21/185) of businesses responding to the survey have implemented or are in the process of implementing a climate change adaptation plan. A significant number of businesses (54%, 101/185) reported some interest in

adopting one but have not yet done so. Meanwhile, 25% (46/185) of respondents reported not having thought about this issue at all, while 4% (8/185) of respondents have thought about introducing a climate change adaptation plan but decided not to do so.

Figure 4.1: Which of the statements below best describes your company's engagement with climate change adaptation? (% of respondents agreeing with each statement)

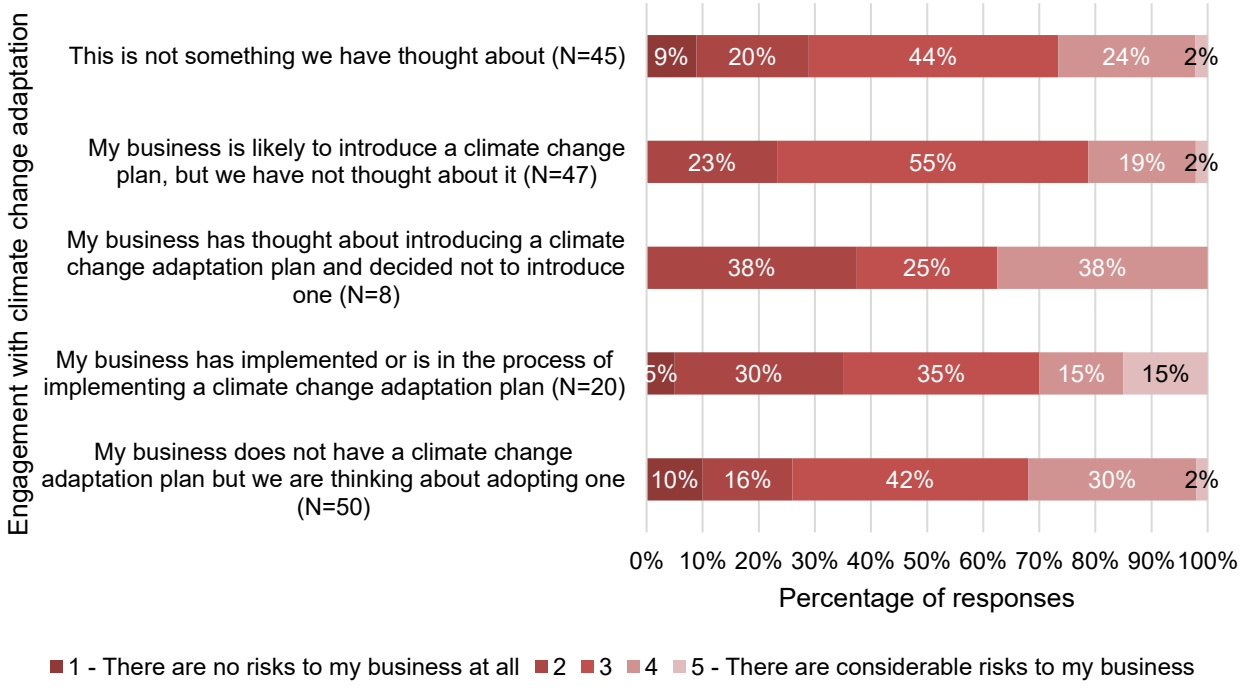


Base=185

Source: Business survey

4.4 It appears that there is no clear relationship between perceptions of risk to businesses from climate change and actions taken. As Figure 4.2 indicates, businesses that have implemented or are in the process of implementing a climate change adaptation plan perceive slightly higher risks than those perceived by business that have not done so. There is no evidence of a statistically significant relationship between these. Meanwhile, businesses that have not thought about implementing a climate change adaptation plan perceive lower risks than those perceived by businesses which have done so. Again, there is no evidence of a statistically significant relationship between the two.

Figure 4.2: Which of the statements below best describes your company's engagement with climate change adaptation? (% of respondents agreeing with each statement) (against perception of risks to business due to climate change)



Base=185

Source: Business survey

4.5 Overall, it appears that with the exception of the 25% (46/185) of businesses which reported not having given this issue any thought, as well as those identifying no risks at all, businesses in Wales think that it is important to act to mitigate the risks that they face from climate change but have not generally done so yet.

4.6 It is notable that a small number of businesses have decided not to implement specific climate change adaptation measures because they believe that their existing risk mitigation strategies are sufficient to deal with these risks. Businesses that indicated that they had considered implementing climate change adaptation measures but decided not to do so were asked: "You said that your business had considered implementing a climate change adaptation plan but decided not to. Why did your business decide not to?" Businesses responded:

> *"*[A climate change adaptation plan] *is too specific in that we do have a business continuity plan that we decided actually covers everything anyway. It doesn't really matter whether it's fire, flood, virus — the same plan is effective for this situation. We didn't need a specific climate change plan — our business continuity plan covers it all anyway."* (**Business survey**)

> *"*[We have not adopted a specific climate change adaptation plan] *because planning for these risks is already included within our ISO certification."* (**Business survey**)

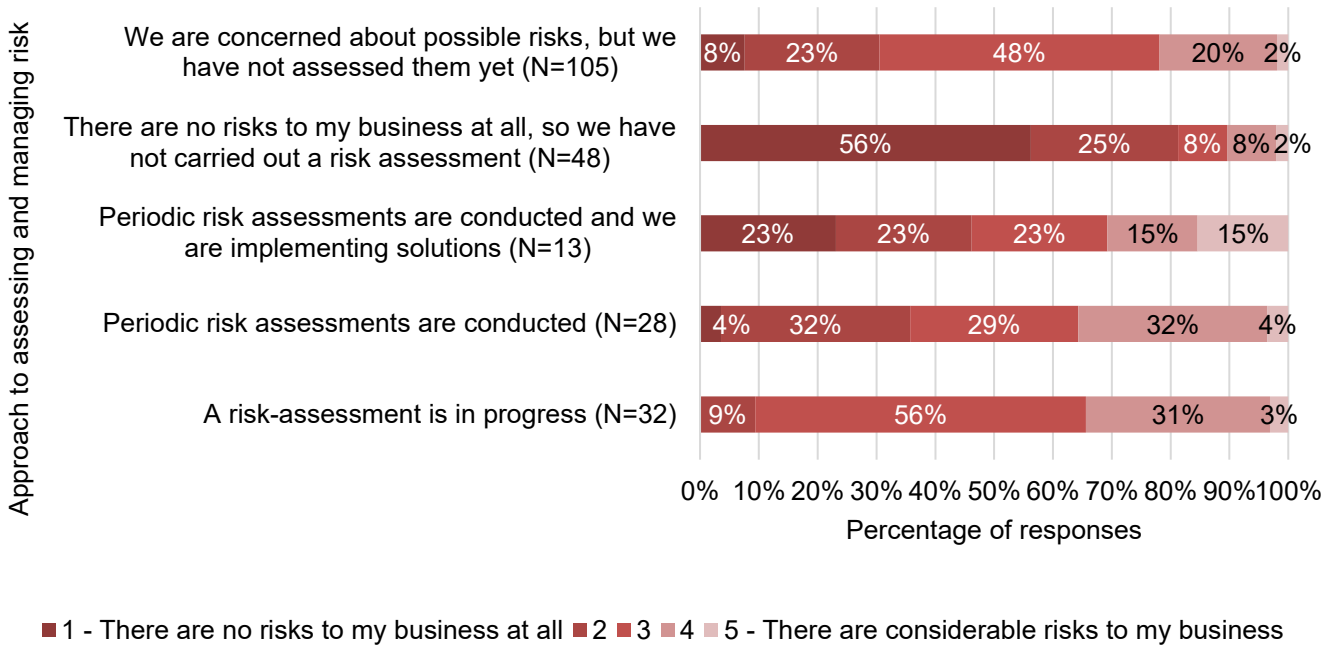
4.7 One of these businesses that felt as though their pre-existing risk mitigation strategies were sufficient participated in a follow-up interview and were asked whether anything would change this assessment. This business reported that were perceived risks to become more severe, there would be the need to revisit this assessment:

> *"With the information we currently have, I would say the business continuity plan still works… but if more specific information on climate change came about that would directly impact us, then we would definitely think about a specific climate change plan."* (**Follow-up interview**)

This suggests that there is scope for the Welsh Government to continue to engage with businesses that feel as though they are adequately aware of the risks that they face, so as to communicate new understandings of risks in Wales and ensure that businesses' assessments of risk are based on up-to-date information.

4.8 Businesses were also asked about their approach to assessing and mitigating risk. As Figure 4.3 indicates, 32% (76/241) of businesses responding to this question reported assessing risks to their business due to increased heat-related events resulting from climate change in some way, with 45% (109/241) identifying potential risks but having not carried out a formal risk assessment, and 23% (56/241) seeing no need for a formal risk assessment because they did not see their business as being at risk at all.

Figure 4.3: Which of the statements below best describes your company's assessment of current and future risks of climate change? (against perception of climate change risk to business)



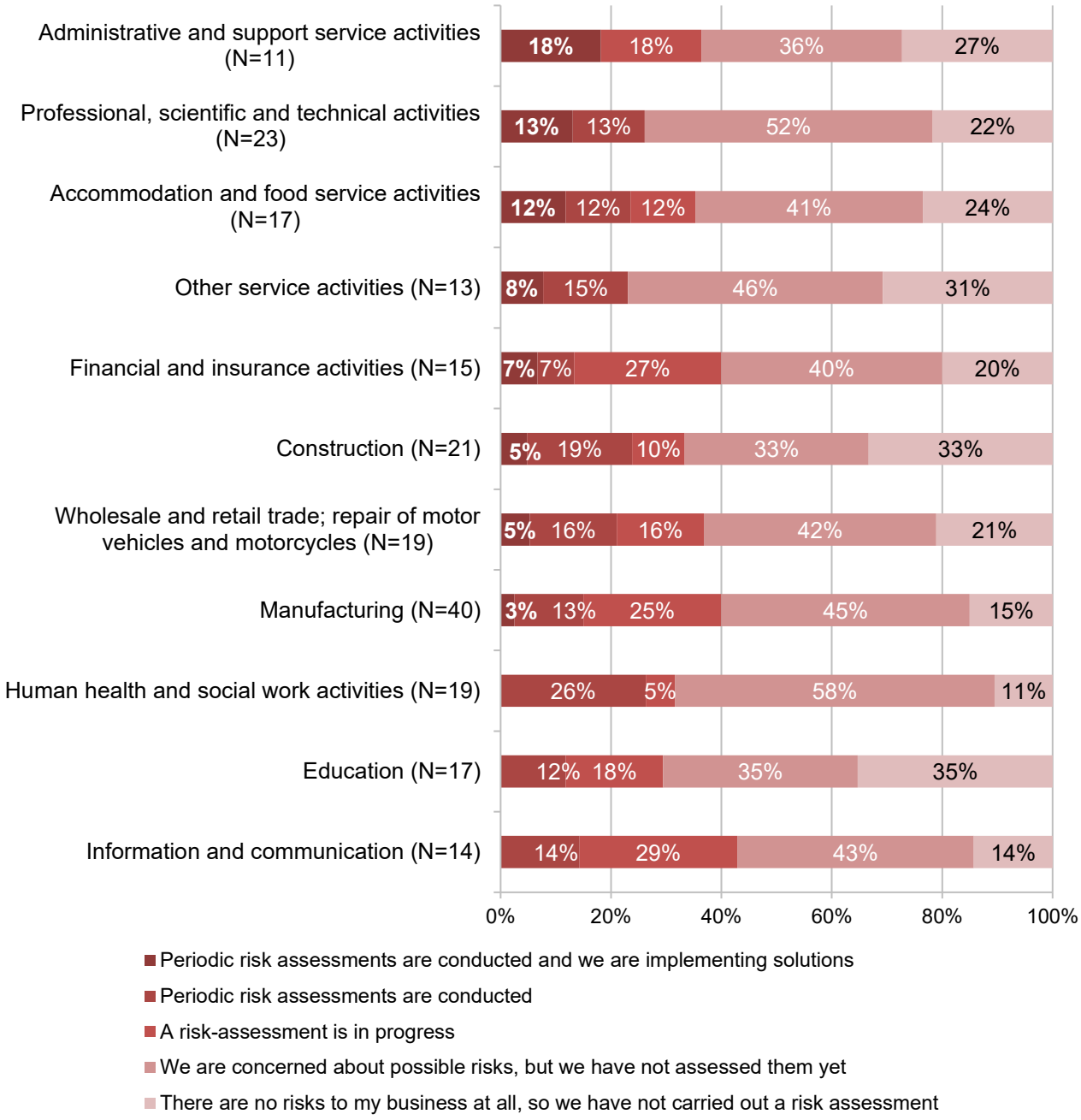
N=241

Source: Business survey

Sectoral Differences in Approaches to Assessing and Acting on Risks

4.9 There are some differences between how different sectors have approached assessing and adapting to climate-related risks. However, as evidenced by Figure 4.4 below, there do not appear to be clear sectoral patterns.

Figure 4.4: Which of the statements below best describes your company's assessment of current and future risks of climate change?



N=209 (sectors with fewer than 10 responses have been excluded)

Source: Business survey

4.10 As only 21 businesses reported having adaptation plans in place, caution must be exercised in identifying sectoral patterns. However, as Figure 4.5 shows, wholesale and retail trade businesses are particularly well represented among businesses either in the process of implementing an adaptation plan or with an adaptation plan in place. As elsewhere, financial and insurance activities are also well represented among businesses with an adaptation plan in place.

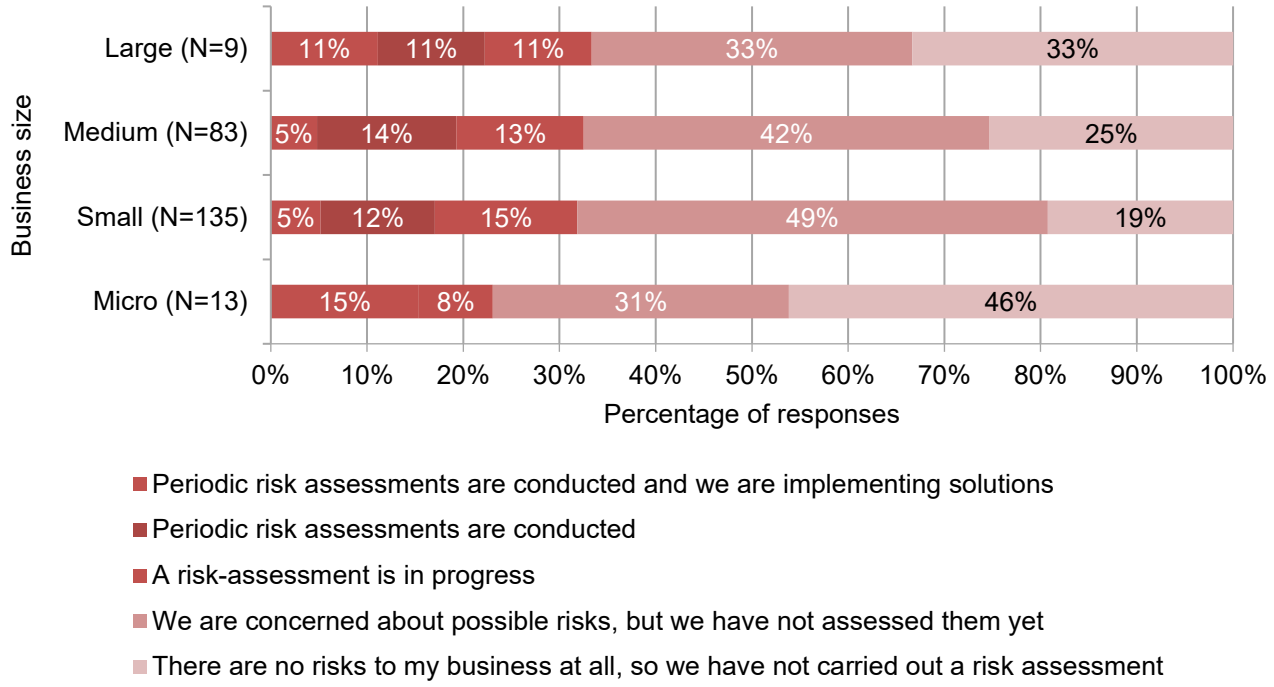
Table 4.1: Which of the statements below best describes your company's engagement with climate change adaptation? Responses where businesses have implemented or are in the process of implementing a climate change adaptation plan

My business has implemented or is in the process of implementing a climate change adaptation plan	Number of businesses responding that agree
Wholesale and retail trade; repair of motor vehicles and motorcycles	5
Financial and insurance activities	4
Manufacturing	2
Professional, scientific and technical activities	2
Construction	2
Other service activities	2
Human health and social work activities	1
Information and communication	1
Administrative and support service activities	1
None of the above	1
Total	**21**

Differences in Approaches to Assessing and Acting on Risks by Business Size

4.11 There does not appear to be a particular relationship between business size and the actions taken by businesses to mitigate the risks due to higher working temperatures and infrastructure disruption. As Figure 4.5 indicates, patterns of responses regarding assessment and mitigation are relatively consistent across business sizes.

Figure 4.5: Which of the statements below best describes your company's assessment of current and future risks of climate change?



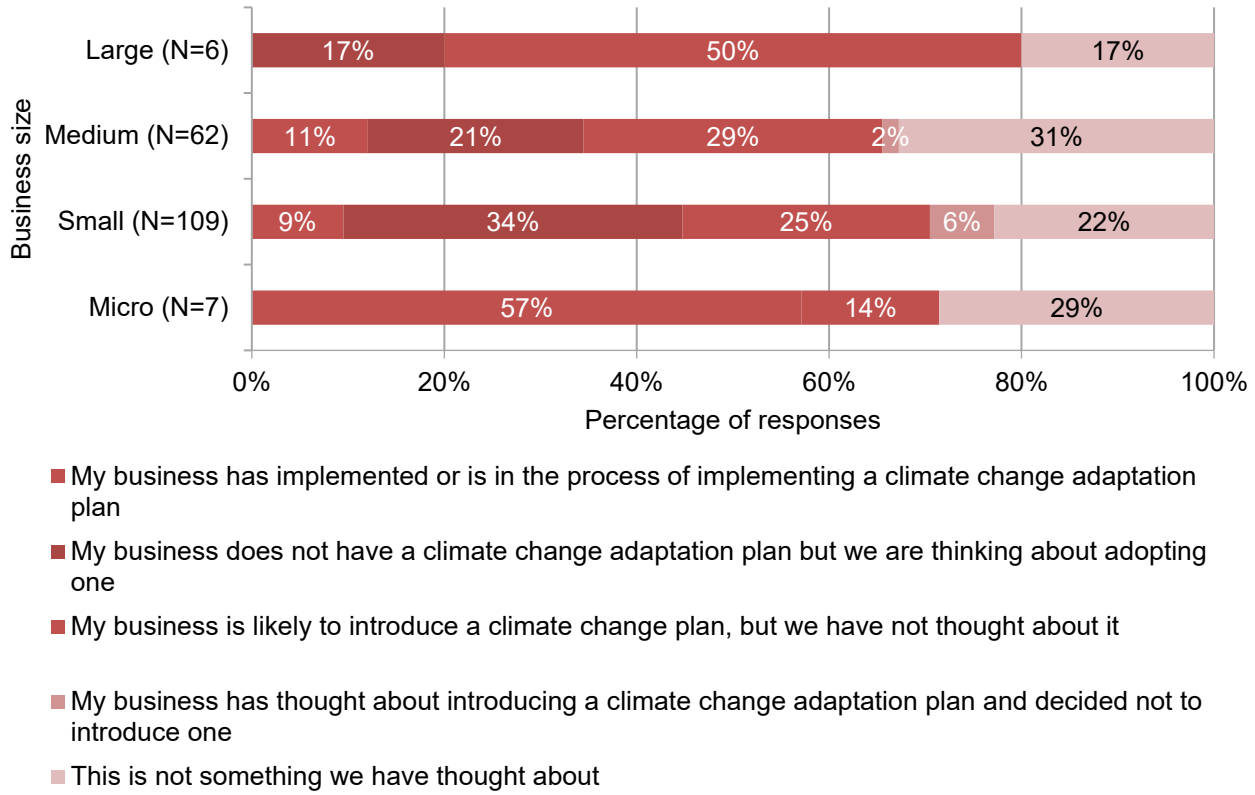
N=240

Source: Business survey

4.12 Notably, however, microenterprises are well represented at both ends of the scale, with the highest proportion of respondents undertaking adaptation activities, as well as the highest proportion of respondents identifying no risks at all due to climate change and, therefore, not intending to carry out a risk assessment.

4.13 Microenterprises are also particularly prominent among organisations that have taken action to plan for and mitigate risks. As Figure 4.6 indicates, 57% (4/7) of microenterprises responding to the survey reported having a climate change adaptation plan in place. It should be noted, however, that the survey was not targeted at microenterprises in particular, and they were not included in the sample frame. These findings are based on a very small sample of businesses.

Figure 4.6: Which of the statements below best describes your company's engagement with climate change adaptation?



N=184

Source: Business survey

4.14 The qualitative data suggests that where adaptation plans have been implemented in micro and small businesses, they have often been driven forward by passionate individuals who are engaged with the issue:

> *"I have been an environmentalist all my life, so the development of a climate change adaptation plan aligns with this."* (**Follow-up interview**)

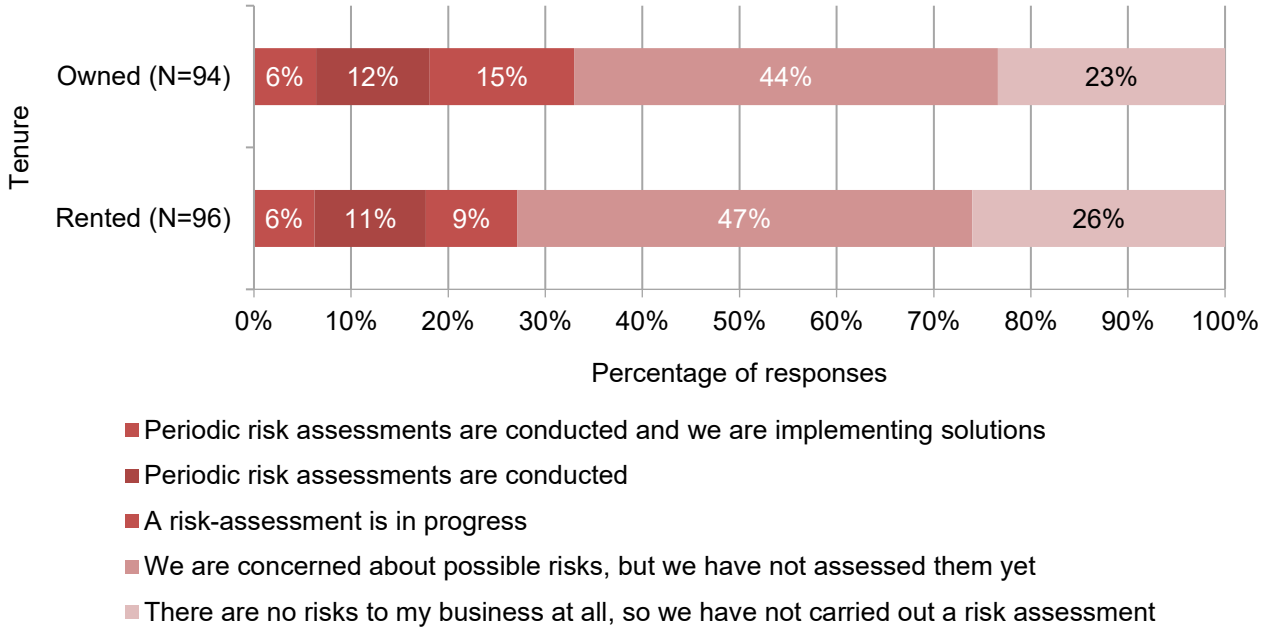
> *"I've driven a lot of this forward myself. The company ethos is based on sourcing local and natural products, so some of things we're doing here align with that: plastics and items with high air miles are off mission for the business anyway."* (**Follow-up interview**)

4.15 This suggests the importance of individuals in driving forward adaptation activities in smaller organisations. Furthermore, it potentially suggests a link between engagement with climate change mitigation activities and businesses' willingness to think about climate change adaptation.

Differences in Approaches to Assessing and Acting on Risks by Tenure

4.16 As one of the key research questions for this work has been to explore whether tenure (i.e. whether business premises are rented or owned) affects businesses' preparedness in dealing with the risks associated with higher working temperatures and infrastructure disruption, these results have been disaggregated by business tenure. As Figure 4.7 indicates, there does not appear to be a clear relationship between business tenure and assessment of these risks, with the proportion of businesses in each risk assessment category being roughly similar for businesses in rented and owned premises.

Figure 4.7: Which of the statements below best describes your company's assessment of current and future risks of climate change? (disaggregated by tenure)

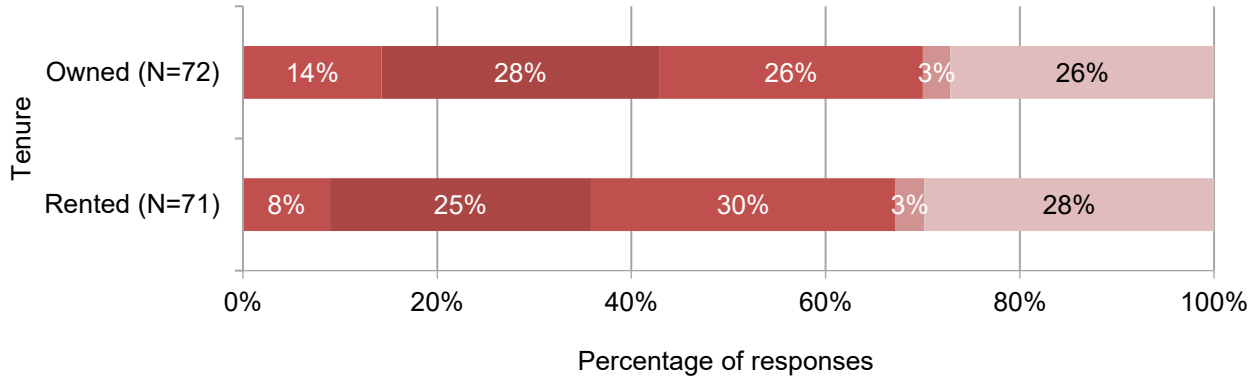


N=190

Source: Business survey

4.17 Likewise, there does not appear to be a pattern between business tenure and the actions taken to mitigate risks due to higher working temperatures and infrastructure disruption. As Figure 4.8 shows, however, almost double the number of businesses in owned premises in comparison to those in rented premises (14% compared to 8%, i.e. 10/72 compared to 6/71) reported implementing adaptation measures.

Figure 4.8: Which of the statements below best describes your company's engagement with climate change adaptation? (disaggregated by tenure)



- My business has implemented or is in the process of implementing a climate change adaptation plan
- My business does not have a climate change adaptation plan but we are thinking about adopting one
- My business is likely to introduce a climate change plan, but we have not thought about it
- My business has thought about introducing a climate change adaptation plan and decided not to introduce one
- This is not something we have thought about

N=143

Source: Business survey

Differences in Approaches to Assessing and Acting on Risks by Working Environment

4.18 The findings have been disaggregated by working environment in order to identify whether there are differences in approach between businesses whose employees work in a manufacturing environment, an outdoor environment and an office environment.

4.19 It appears that businesses whose employees are primarily office-based (11%, 7/64) are more likely to be periodically assessing risks and implementing measures in order to mitigate the effects of climate change than are businesses in manufacturing (3%, 1/40) or outdoor settings (4%, 1/26).

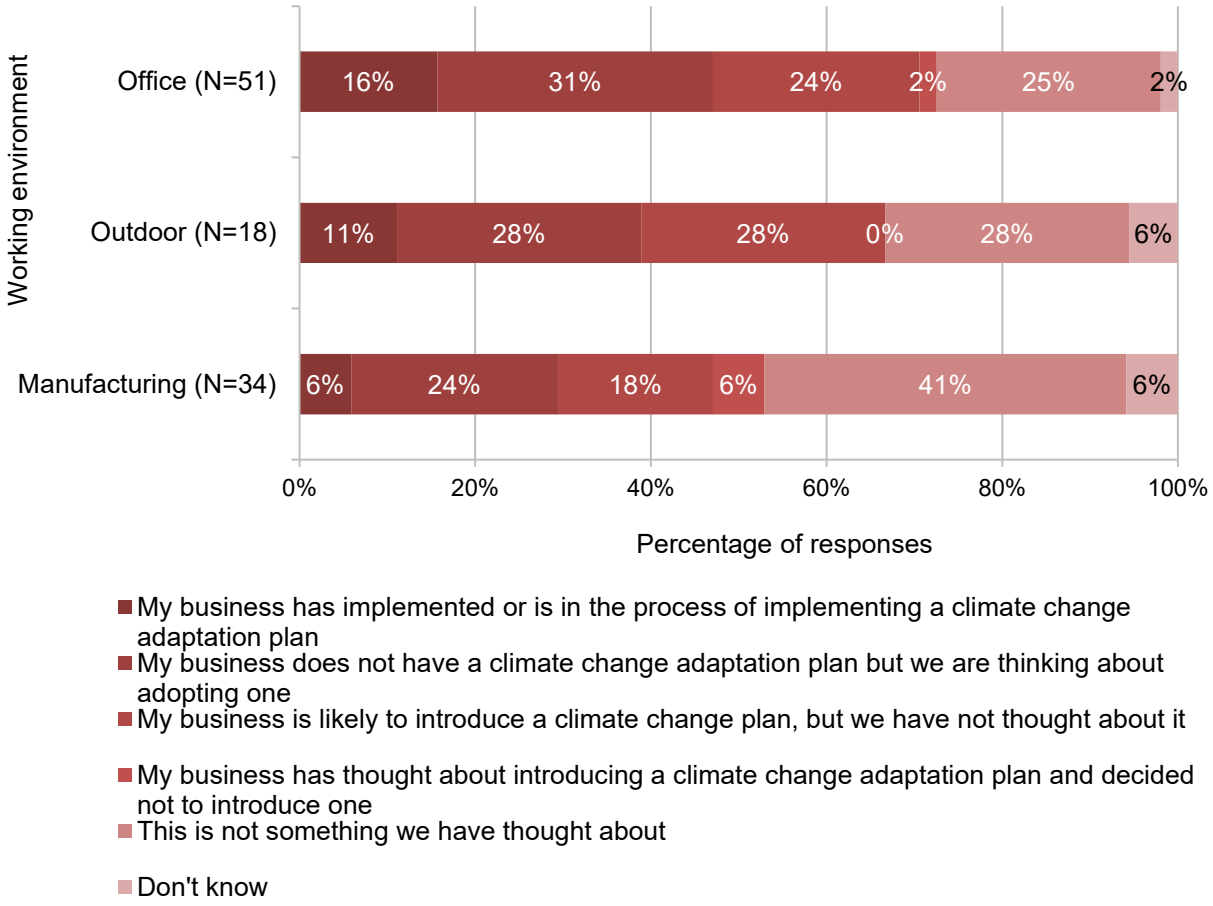
Figure 4.9: Which of the statements below best describes your company's assessment of current and future risks of climate change?

N=130

Source: Business survey

4.20 Consistent with these findings, 16% (8/51) of office-based businesses that identified risks to their business in these areas reported that they have implemented measures to adapt to and mitigate these risks. This compares to 11% (2/18) of businesses whose employees work outside and 6% (2/34) of manufacturing businesses reporting that they have a climate change adaptation plan in place.

Figure 4.10: Which of the statements below best describes your company's engagement with climate change adaptation?



N=103

Source: Business survey

Additional Analysis of Approaches to Assessing and Acting on Risks

4.21 Additional analyses of approaches to assessing and acting on risks were carried out. Variables explored included regional differences, building age, and location of headquarters. No particular patterns were identified in these findings. These findings have been included in Annexe C of this report.

5. Barriers and Drivers for Businesses Assessing and Mitigating Risks

5.1 This chapter outlines the barriers preventing businesses from assessing and mitigating risks due to higher working temperatures and infrastructure disruption. In addition, the chapter outlines findings regarding business perceptions on the factors driving adaptation.

Key points:

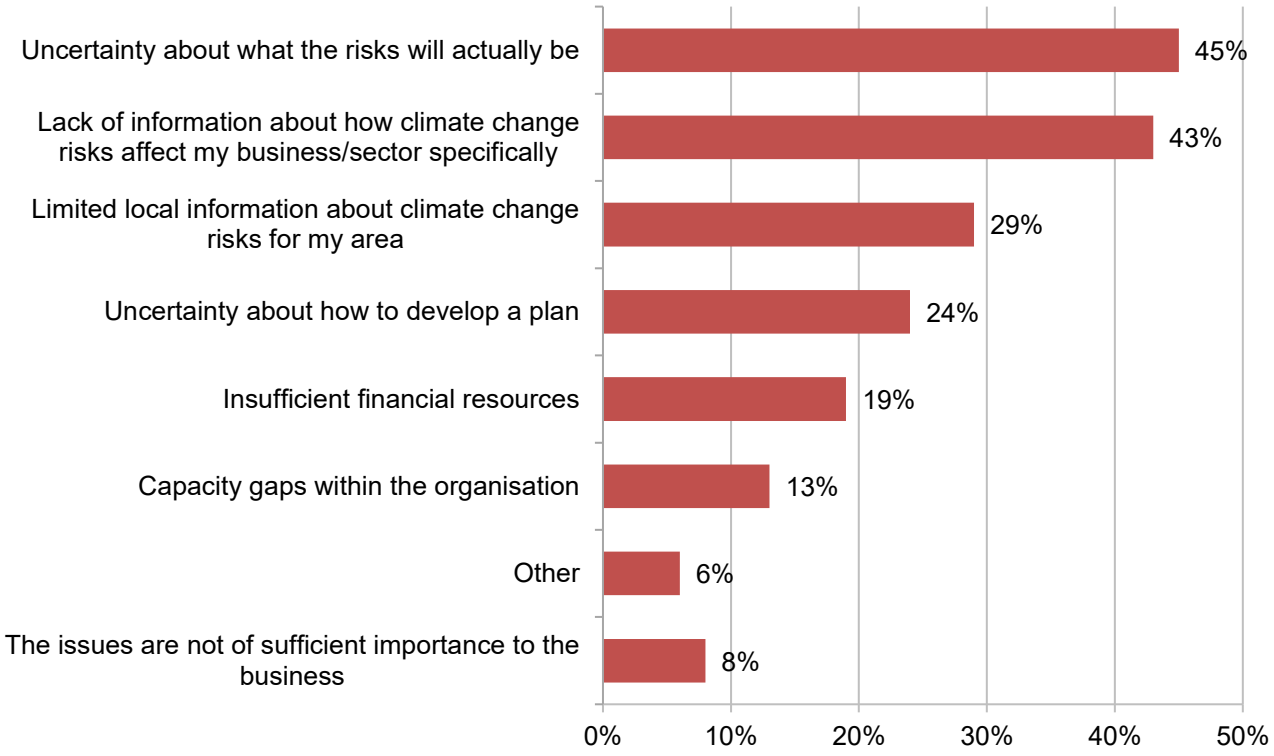
- The data collected in this research identifies that the primary barrier to adaptation facing businesses in Wales is insufficient information on specific sectoral risks and how higher working temperatures and infrastructure disruption are anticipated to affect specific sectors.
- The data indicates a perception that businesses themselves feel that they have the ultimate responsibility for ensuring that they adapt to the effects of climate change. At the same time, businesses recognise a role for the Welsh Government in supporting adaptation, particularly with regard to addressing information deficits.
- In general, businesses do not perceive higher working temperatures and infrastructure disruption to be problems that have affected productivity in the last five years. There does appear, however, to be a relationship between perceptions of these issues having affected productivity in the past five years and businesses assessing risks and introducing adaptation plans.
- It appears that individual senior staff are often responsible for driving adaptation within small and medium-sized businesses. It is possible to characterise these businesses as early adopters, and different strategies may be required in order to drive adaptation within other businesses.

  The Welsh Government should carefully consider which businesses are likely to be opinion formers in order to potentially use their experiences to demonstrate the benefits of introducing an adaptation plan to other businesses in Wales.

Barriers Facing Businesses

5.2 Businesses were asked about the primary barriers preventing them from drawing up climate change adaptation plans. Knowledge and information on the risks were identified by survey respondents as being the most significant barriers to adaptation. Figure 5.1 shows that 'uncertainty about what the risks will actually be' (45%, 45/100) is the most commonly identified risk, with 'lack of information about how climate change risks affect my business/sector specifically' (43%, 43/100) and 'limited local information about climate change risks for my area' (29%, 29/100) being the most frequently identified barriers.

Figure 5.1: What are the main barriers preventing you from putting an adaptation plan in place?



N=100

Source: Business survey

Lack of information on risks

5.3 These findings were also found in the in-depth interviews, wherein businesses reported desiring a better understanding of the types of risks that they would be facing in order to draw up adaptation plans:

> *"I think for us it's just having knowledge up front. If we know how to react to these things, we know how to plan and do things for ourselves. It's where we don't know what's coming. If we know in advance, we can make appropriate plans to make sure people have the right equipment and can shift things to areas that aren't affected."* (**Follow-up interview**)

> *"It would be very useful* [to have a climate change adaptation plan]*, but I'm not sure that we can predict the exact impact of climate change. I'm currently doing my business managers' report, and a quote I've used from the Met Office describing 2019 as a year of extremes, record-breaking heat and rain, along with notable spells of cold and windy weather — have all been prominent."* (**Follow-up interview**)

> *"If we had more of an in-depth insight into what problems would occur* [for our business]*, then we could tackle the problems before they happen."* (**Follow-up interview**)

5.4 This suggests that businesses do not have accurate and up-to-date information on what risks businesses face. It appears that some businesses perceive messaging with regard to climate change in Wales to be very general, and that businesses would welcome information focusing on specific sector-by-sector and regional risk scenarios.

Lack of information on how to mitigate risks

5.5 Other barriers were identified regarding the challenges of developing and implementing plans. For example, 24% (24/100) of businesses identifying risks but not having a plan in place identified uncertainty surrounding how to develop one as being a barrier, while 19% (19/100) of businesses identified insufficient financial resources and 13% (13/100) capacity gaps within organisations as being barriers. Again, these findings were reflected in the follow-up interviews:

"[We would need information on] *what content we should include, how to structure it — just further knowledge than what we already have. We already know about infrastructure problems but we need to know how to go about resolving those issues."* (**Follow-up interview**)

5.6 There is the potential for the Welsh Government to provide support here by providing examples of risk mitigation strategies covering higher working temperatures and infrastructure disruption. These could include examples of sector-specific adaptation plans, providing additional information on certain priority sectors. The collection of case studies was considered to be part of this research; however, the data collected from businesses with adaptation plans in place was of insufficient quality or detail for this to be possible.

Lack of familiarity with the issue

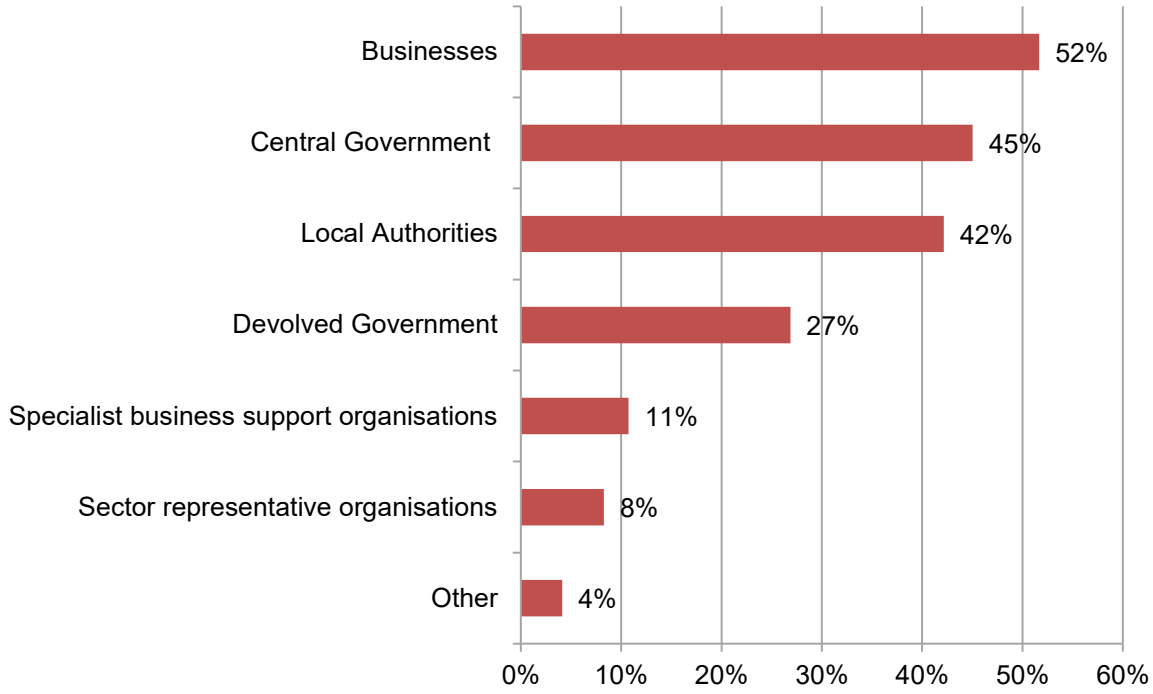
5.6.1 It might be that encouraging businesses to develop climate change adaptation plans may not be the best way in which to engage businesses with regard to this issue. The data collected in this research suggests that organisations responding have not always understood exactly what the issues are. Businesses may find it easier to engage with these issues if framed more generally in terms of business continuity management and risk.

5.7 Some businesses reported that they did not see a distinction between existing strategies for dealing with heatwaves and infrastructure disruption and specific risks in these areas associated with climate change. There is the potential that in the context of disruption to businesses caused by COVID-19, businesses are particularly open to thinking about other aspects of risk and business continuity.

Perceptions of Responsibility for Adaptation among Businesses

5.8 Businesses were asked about whom they identified as having responsibility for ensuring that businesses adapt to the effects of climate change. Overall, the businesses surveyed most frequently identified themselves as having responsibility for ensuring that they adapt, as shown in Figure 5.2 below.

Figure 5.2: Whom do you identify as having responsibility for ensuring that businesses adapt to the effects of climate change?



N=242

Source: Business survey

5.9 When asked the same question as part of the follow-up interviews, more qualitative detail was provided. This additional information suggested that businesses identify primary responsibility at the business level because of how bespoke adaptation plans need to be:

> *"On this level, it has to be local business management. The only thing that government can do and/or local councils is actually impact on CO2 emissions."* (**Follow-up interview**)

> *"The businesses themselves* [have responsibility] *because it's their business. They have to run it. They have to take responsibility for their decisions. Every business is unique and will have different things that affect them, so they need to make decisions themselves."* (**Follow-up interview**)

5.10 At the same time, in the survey data and in the qualitative follow-up interviews, businesses highlighted the need for national or central government to provide guidance and support, including financial support, for businesses:

"I think it's central or local government's responsibility to make sure the information is out there, but it's a combined responsibility of both businesses and local government to make sure businesses can cope with what that interruption is." (**Follow-up interview**)

"Central government [need to be involved]*. It's got to* [be] *a top-down approach. Companies are trying to do their bit, but we need the guidance and information — that needs to get filtered down into the industry."* (**Follow-up interview**)

"I think the government has a role in terms of providing support and guidance to businesses about preparations they can make to combat the effects of climate change. It would also be useful for the government to provide grants to help businesses make adaptations to buildings. The changes must be driven by the businesses themselves, but they need advice and support." (**Follow-up interview**)

5.11 A particular theme within this feedback was the fear that government might produce legislation requiring businesses to adapt (and the potential additional bureaucracy associated with it). In addition, some businesses expressed a concern that there may be different requirements and potentially different advice from different organisations and different parts of government:

"I think sometimes if these things aren't thought through properly, they can be an unnecessary burden. One thing that could be a problem, because we deliver services and contracts under the local government, is that if something gets introduced at a national policy level, by the time it gets sent down to local government, we end up with 152 different versions of the same information. It's massively duplicated and bureaucratic." (**Follow-up interview**)

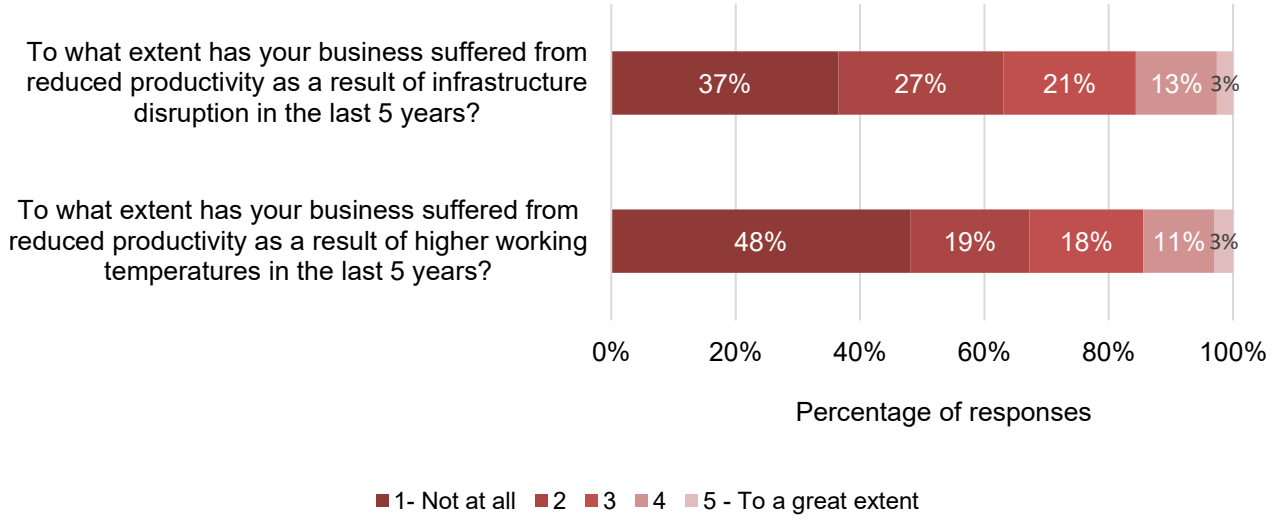
"The last thing businesses need is more legislation and compliance monitoring, as this just makes us less competitive. We need a simple guidance plan with simple actions we can take. It would be useful to have a pro forma climate change adaptation plan, but the support has to be simple and easy to understand." (**Follow-up interview**)

5.12 This theme does not appear to vary by business size and there does not appear to be any clear pattern between sectors and perceptions of responsibility for climate change adaptation. This analysis has been included in Annexe C of this report.

Previous Experience of Higher Working Temperatures and Infrastructure Disruption as Drivers of Adaptation

5.13 The data collected in the business survey suggests that businesses have not experienced high levels of reduced productivity due to higher working temperatures. Businesses were asked 'To what extent has your business suffered from reduced productivity as a result of higher working temperatures in the last 5 years?' and 'To what extent has your business suffered from reduced productivity as a result of infrastructure disruption in the last 5 years?' on a scale of 1–5. Figure 5.3 shows that (overall) previous experience of these issues is low. This may explain why businesses see this as being an area in which they will need to act but have thus far deferred doing so.

Figure 5.3: 'To what extent has your business suffered from reduced productivity as a result of higher working temperatures in the last 5 years?' and 'To what extent has your business suffered from reduced productivity as a result of infrastructure disruption in the last 5 years?'



N=235/230

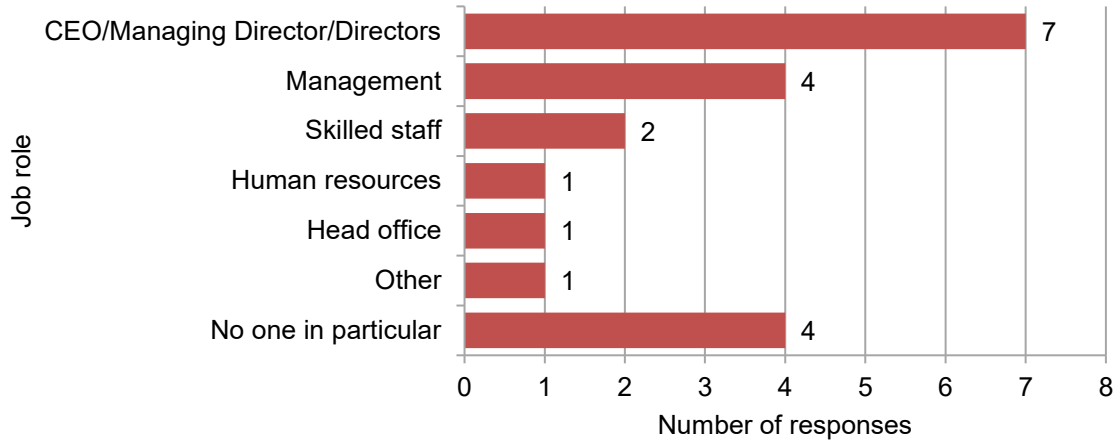
Source: Business survey

Early Adopters

5.14 As noted previously in this report, many of the individuals reporting taking action linked climate change **adaptation** to climate change **mitigation**. The same is true for some taking action to introduce an adaptation plan: passion for the issue is driving some to introduce adaptation methods. In other words, they are seeing this as being a risk area because they are also committed to reducing their business' carbon footprint.

5.15 The research indicates that for businesses with adaptation plans in place, individuals have a key responsibility for ensuring that their business assesses risk and introduces adaptation measures. In the business survey, businesses with adaptation plans were also asked who within the business had responsibility for driving forward the development of an adaptation plan. As Figure 5.4 indicates, in general it has been senior management that has driven the adoption of adaptation plans. Being managed at a senior level potentially suggests that climate change adaptation is being managed alongside other business continuity issues.

Figure 5.4: Were there individuals within your organisation who were the main drivers for your business adopting a climate change adaptation plan? If so, who were they?



N=18

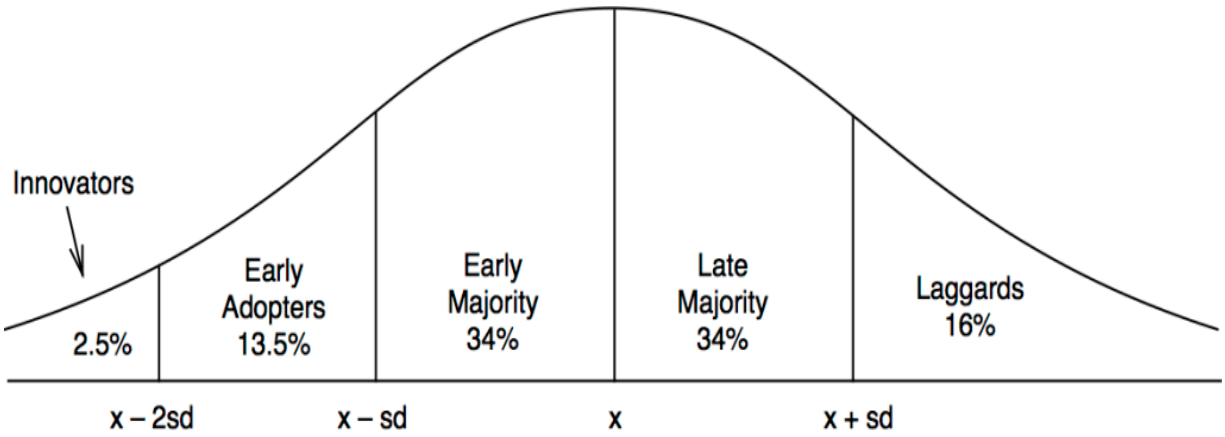
Source: Business survey

5.16 Irrespective of the drivers for these individuals, it is possible that these are 'innovators' and 'early adopters'. They stand out as individuals and businesses that have adopted the idea ahead of the general business population in Wales. In this regard, it is possible that the interests and motivations of the individuals involved in making management decisions have been more influential than external pressures in determining whether businesses have introduced adaptation plans.

5.17 The terms 'early adopter' and 'innovator' derive from Everett Rogers' Diffusion of Innovation Model (1962). The model is used to describe the uptake of a new idea or technology within a social system. The model shows that when new ideas spread, they do so unevenly. A result of this is that when implementing behavioural change innovations, different segments of the 'population' require different messaging strategies.

5.18 As demonstrated in Figure 5.5 below, Rogers' model is segmented into five different adopter categories.

Figure 5.5: Diffusion of Innovation Model



Source: E.M. Rogers, *Diffusion of Innovations*, p. 251.

5.19 Rogers characterises the adopter categories as follows.

- **Innovators** – These are people who want to be the first to try an innovation. These people are very willing to take risks and are often the first to develop new ideas. Very little, if anything, needs to be done to appeal to this population.
- **Early Adopters** – These are people who represent opinion leaders. They enjoy leadership roles and embrace change opportunities. They are already aware of the need to change and, therefore, are very comfortable towards adopting new ideas. Strategies for appealing to this population include how-to manuals and information sheets on implementation. They do not need information to convince them to change.
- **Early Majority** – These people are rarely leaders, but they do adopt new ideas before the average person. That being said, they typically need to see evidence that an innovation works before they are willing to adopt it. Strategies for appealing to this population include success stories and evidence of an innovation's effectiveness.
- **Late Majority** – These people are sceptical of change and will only adopt an innovation after it has been tried by the majority. Strategies for appealing to this population include information on how many other people have tried an innovation and have adopted it successfully.

- **Laggards** – These people are bound by tradition and very conservative. They are very sceptical of change and are the most difficult group to bring on board. Strategies for appealing to this population include statistics, fear appeals, and pressure from people in the other adopter groups.

5.20 Reflecting these categories, it could be hypothesised that many of those that have already taken action to introduce adaptation strategies are among the innovator and early adopter categories. Following this assumption, the remaining businesses that are not actively assessing risks and implementing strategies would fall within the early and late majority categories, thinking about the issue but currently undervaluing the benefits of adopting adaptation strategies and overestimating the costs.

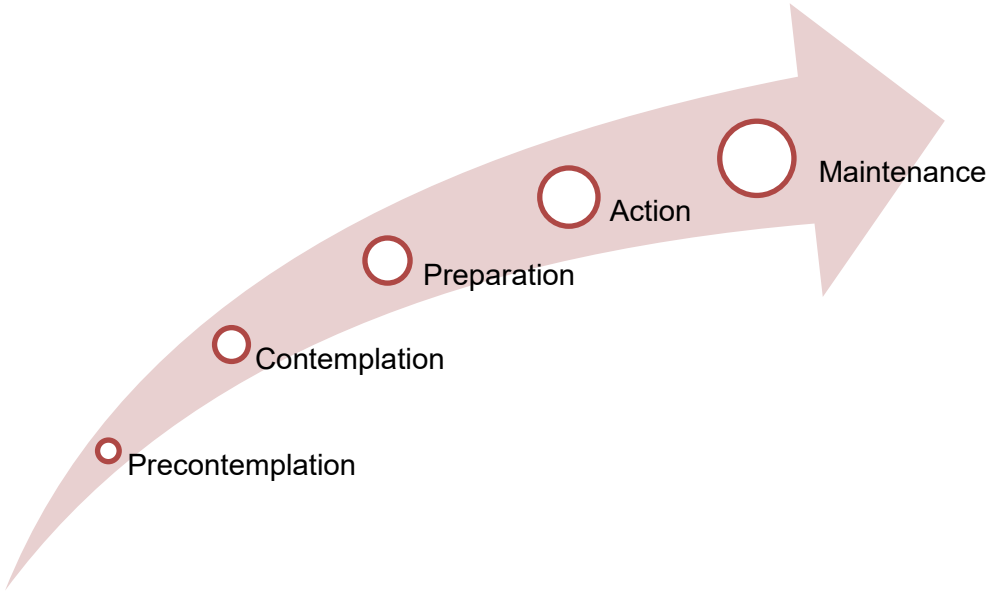
5.21 In order to convince the early and late majority to take action, it may be necessary to demonstrate the benefits of action and the cost of inaction. Doing so may require communication with the business community with regard to what the risks are, as well as highlighting best practice to encourage others to take action. In the latter area, the Welsh Government could identify influential businesses which are likely to inspire others to take action or to create a norm around having adaptation plans.

Welsh Government's Role in Supporting Businesses

5.22 In order to encourage businesses to take a more proactive approach to assessing and mitigating risks due to climate change and higher working temperatures, there may be value in viewing this as a behavioural change problem.

5.23 A common approach to behavioural change is the Transtheoretical Model. Initially developed by Prochaska and DiClemente (1983) in a health context, the model is now widely used to assess behavioural change interventions.

Figure 5.6: Prochaska and DiClemente's Transtheoretical Model



Source: Wavehill's own illustration based on Prochaska and DiClemente's model

5.24 As Figure 5.6 shows, the model developed in Prochaska and DiClemente (1983) posits that changes happen through five stages.

- **Precontemplation** – In this stage, people do not intend to take action in the foreseeable future. People are often unaware that their behaviour is problematic or produces negative consequences. People in this stage often underestimate the pros of changing behaviour and place too much emphasis on the cons of changing behaviour.
- **Contemplation** – In this stage, people are intending to change behaviour in the foreseeable future, recognising that their behaviour may be problematic, and a more thoughtful and practical consideration of the pros and cons of changing the behaviour takes place, with equal emphasis placed upon both.
- **Preparation (Determination)** – In this stage, people are ready to act. People start to take small steps towards the behavioural change.
- **Action** – In this stage, people who have recently changed their behaviour intend to continue moving forward with that behavioural change.
- **Maintenance** – In this stage, people have sustained their behavioural change for a while and intend to maintain the behavioural change going forward.

5.25 The data collected in this research suggests that the majority of the businesses sampled are identifying risks associated with climate change to be something about which they need to think, albeit not taking active steps to prepare for them. Using the Transtheoretical Model, it appears that this majority of businesses are in the contemplation phase of behavioural change.

5.26 One suggestion regarding how to move businesses from the contemplation stage to the preparation or action stage is to provide more information on what the potential risks for businesses are, including sector- and region-specific scenarios. Providing this information to businesses may convince businesses of the cost of inaction in this area.

5.27 One example of how this information might be provided stems from Adaptation Scotland. Adaptation Scotland is a programme funded by the Scottish Government and delivered by the sustainability charity Sniffer.[23] Adaptation Scotland provides tailored support for communities, the public sector and the private sector in Scotland. As part of this support, Adaptation Scotland provides specific, tailored advice for individual sectors. In addition, it provides resources for businesses carrying out business-specific risk assessments and drawing up appropriate action plans. Such advice and support cut across many areas of climate change adaptation but include heat-related support.

[23] Adaptation Scotland

6. Conclusions and Recommendations

6.1 The conclusions presented in this section are drawn based on evidence collected during fieldwork carried out in March 2020, including a bilingual (English and Welsh) business survey (243 responses) and bilingual follow-up interviews (10 responses). The survey was removed from the field earlier than originally anticipated due to disruption caused by COVID-19. For more information on how this may have impacted the robustness of the findings please see chapter two of the report.

6.2 The conclusion is structured around the questions that were explored during the research, specifically:

- Businesses' perceptions of the risk of a decline in worker productivity due to infrastructure disruption and higher working temperatures and how it varies between business sizes and business sectors, as well as how it varies between manufacturing and office environments.
- Whether or to what extent businesses in Wales have adequate business adaptation plans in place to manage a potential decline in workforce productivity and infrastructure disruption as a result of increased temperatures, as well as why businesses do not have adequate adaptation plans in place.
- Whether additional support is required in order to aid businesses in developing robust business adaptation plans.

Main Findings

6.3 The research has identified that while many businesses in Wales are thinking about the ways in which climate change may affect them, assessing and mitigating risks due to higher working temperatures and infrastructure disruption is not a pressing priority for many of them. From this it can be concluded that businesses will need support, primarily in relation to understanding specific risks, in order to move towards action on mitigating these risks.

Perceptions of risk

6.4 The majority of businesses responding to the survey identified some perceived risks due to climate change, including specific risks due to higher working temperatures and infrastructure disruption. However, the majority of businesses responding to the survey perceived these risks to be neither severe nor pressing. Only a very small number of businesses surveyed identified great risks from higher working temperatures (4%, 9/242) or infrastructure disruption (5%, 11/242). A potential factor influencing this assessment is that while many businesses are concerned about potential risks, they are unclear as to what the specific risks to their business are, including specific sectoral risks and risks affecting different areas of Wales.

6.5 It is notable that a small but significant minority of businesses do not perceive any risks to their business at all due to climate change (17% of respondents, 39/227), and more businesses perceive risks in other areas but do not perceive risks due to either higher working temperatures or infrastructure disruption.

6.6 There are some sectoral differences between perceptions of risk, although no clear pattern emerges. For example, businesses whose workers primarily work outside perceive the greatest risk of reduced worker productivity due to higher working temperatures. Office-based businesses also perceive higher-than-average risks of reduced productivity due to higher working temperatures. However, manufacturing businesses perceive below-average risks due to climate change in this area.

Businesses' approaches to assessing and acting on risks

6.7 The data indicates that businesses in Wales generally intend to act to adapt to the risks posed by climate change, but the majority have not yet taken action. Only 11% (21/185) of businesses responding to the survey have implemented or are in the process of implementing a climate change adaptation plan. A significant number of businesses (54%, 101/185) reported some interest in adopting one but have not yet done so.

6.8 Although businesses do perceive there to be risks due to climate change, including in relation to higher working temperatures and infrastructure disruption, relatively few are taking action in order to fully understand and mitigate these risks. Only 32% (76/241) of the businesses surveyed reported assessing risks due to climate change through a formal risk assessment process. Similarly, although 32% of the businesses surveyed reported carrying out some kind of formal risk assessment, only 11% (21/185) of the businesses reported having put in place a climate change adaptation plan.

6.9 Some respondents reported that they had considered the risks due to climate change but considered their existing risk management strategies to be sufficient because they already included heatwaves and infrastructure disruption. This potentially suggests that risk management and business continuity may be, for some businesses, a more effective way of engaging businesses with this issue than approaching it through the lens of climate change adaptation.

6.10 Risk and business continuity management may also be a good way of engaging businesses in future research of this nature. The focus on climate change potentially confused some businesses responding to the survey, which, it appears, were thinking about climate change mitigation rather than climate change adaptation. That is to say, they were thinking (when responding to the survey) about the actions that a business might take in order to reduce negative impacts on the climate, rather than the actions that a business might take so as to adapt to climate change.

6.11 However, although there was some confusion, another finding was that the businesses that were most advanced with their adaptation plans often involved individuals who were interested because of their interest in and passion towards mitigation. A consequence of dropping climate change and leading with risk and business continuity may be that these individuals are less engaged with further research.

Drivers of business adaptation

6.12 There appears to be some relationship between businesses' previous experience of productivity disruption due to higher working temperatures and infrastructure disruption and action in this area. Survey data indicates that businesses with an adaptation plan in place were more likely to identify previous disruption than were businesses that are considering adopting one. Likewise, businesses considering adopting one are more likely to identify previous disruption than are businesses that are not considering introducing one.

6.13 The research has found that individuals are often instrumental in driving adaptation within SMEs. Passionate individuals who are well aware of climate risks are driving these businesses' efforts forward in this area. Furthermore, there is some evidence that businesses that are particularly passionate towards reducing their impact on the climate are also leading efforts to adapt to the effects. It may be possible to characterise businesses that have taken action as 'innovators' or 'early adopters'.

6.14 It is likely that businesses that have not yet taken action to mitigate business continuity risks due to extreme heat will need to be influenced differently by highlighting the costs of failing to adopt a plan and the benefits of doing so. It may be possible to use 'opinion formers' within the business community to influence other businesses to take action.

Barriers and support needs for businesses in Wales

6.15 The data collected in the survey indicates that the primary barrier preventing businesses in Wales from implementing climate change adaptation plans is a lack of information. Businesses reported that they do not know enough about what the risks are to take action at present. The perceived information deficit includes specific sectoral risks.

6.16 As a secondary support need, businesses reported requiring information on the steps that they can take in order to mitigate risks. This could include how to assess risks, potentially in the context of modelled climate change scenarios, and measures that businesses could take so as to mitigate the risks. Other support needs identified by businesses included the financial costs of adaptation and having internal capacity dedicated to drawing up and maintaining a climate change adaptation plan.

6.17 The difficulty that businesses found while engaging with this issue is potentially another barrier. Businesses are not used to engaging with this area and there was confusion surrounding the difference between climate change mitigation and climate change adaptation.

6.18 Likewise, some businesses reported that they were not developing specific climate change adaptation plans because they believed that extreme warm weather and infrastructure disruption were adequately covered by their existing risk management and business continuity strategies.

6.19 This suggests that business continuity and risk management may be a better angle from which to approach businesses with regard to this issue, either in governmental social research or when encouraging and supporting businesses to take action. The experience of disruption due to COVID-19 may mean that businesses are open to thinking about business continuity planning in other areas at this time.

6.20 **Recommendation One:** When approaching issues of climate change preparedness, specifically issues surrounding the mitigation of higher temperatures, the Welsh Government may wish to consider reframing the issue. Based on the research carried out in this project, it appears that this is an issue with which businesses in Wales are unfamiliar. For a significant number of businesses, there is confusion surrounding what climate change adaptation is and how it differs from climate change mitigation. For others, they perceive no need to consider specific adaptation activities for threats related to climate change because they consider them to be covered by more general risk management frameworks, which already include factors such as heatwaves and infrastructure disruption. Consequently, it is difficult to engage businesses with this issue when framed as one of climate change

adaptation. **Framing the issue as a more general issue of risk preparedness and business continuity may be a more effective way of engaging with businesses in relation to this area.** The disruption due to COVID-19 has forced businesses to think more about business continuity and this might be a successful angle from which to engage businesses after the experience of COVID-19.

Perceptions of responsibility for climate change adaptation and the role of Welsh Government

6.21 The data collected suggests that businesses identify themselves as having the ultimate responsibility for climate change adaptation. Qualitative data collected in the survey suggests that businesses have some concerns surrounding the possibility of legislation in this area, and several businesses reported the need for consistency in the advice and messaging that they receive from the Welsh Government, the UK Government, and other support agencies.

6.22 Despite some reservations, businesses see a role for the Welsh Government in helping them to adapt to the effects of climate change. The most pressing support need that could be addressed by the Welsh Government is the need for accurate and up-to-date information on the risks of climate change. There is a role for the Welsh Government in informing businesses of what the risks are, which could potentially be achieved by providing modelled scenarios outlining specific sectoral risks.

6.23 **Recommendation Two:** The primary climate change adaptation business support need for businesses in Wales appears to be in relation to providing information. The main information deficit appears to be in relation to what the precise risks for specific sectors and regions are. The Welsh Government should consider filling this information deficit by modelling some sector-specific scenarios with which to engage businesses.

6.24 As a secondary need, businesses require examples of adaptation plans in order to understand what measures they could put in place to mitigate the effects of climate change. The Welsh Government could potentially explore the model of provision implemented by Adaptation Scotland when developing its own support.

6.25 **Recommendation Three:** The Welsh Government should consider working with ‘early adopters’ to identify how businesses have put strategies in place to assess and mitigate risks due to higher working temperatures and infrastructure disruption. Working with early adopters to identify what their businesses have included in adaptation plans could lead to a series of examples that could be provided to businesses thinking of introducing an adaptation plan.

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Annexe A: Research Tools

Business Survey

This survey is part of a research project that Wavehill is conducting (on behalf of the Welsh Government) to identify businesses' readiness for higher working temperatures and infrastructure disruption. The UK's independent Climate Change Committee carried out a risk assessment in 2017 which found that more research is needed to understand the potential impact of higher temperatures on businesses in Wales. It is thought that businesses may be at risk of disruption to ICT, power and transport infrastructure, preventing workers from accessing premises or working remotely, and that higher temperatures may impact on employee safety and productivity, but there is no evidence base to show whether this is, or is not, a risk.

This research will identify what the risk is and how ready Welsh businesses are to adapt. It will then be used by Welsh Government to identify how best to support businesses to make these changes.

Participation in this survey is, of course, optional and should take around 10 minutes to complete. Participants will be entered into a draw to win one of five £50 donations to a charity of their choice.

If you wish, you can find out more about your rights under GDPR and how the data you provide will be used by Wavehill and Welsh Government in the privacy notice for this project, which is available here. Individual responses will be anonymised and findings reported in aggregate form only.

For more information about the study please feel free to contact Tom Marshall at Wavehill (tom.marshall@wavehill.com) or Isabella Malet-Lambert at Welsh Government ().

Risks to Businesses Survey:

In order to understand what type of businesses higher working temperatures and infrastructure disruption will affect most, we would like to take some information about your business. This will not be used in a way that makes you or your business identifiable.

To start, can we just confirm the following:

- Wales postcode _____

Can we just check, is the site you work at….

- The business' only site
- One of a number of sites

Display this question:
If Can we just check, is the site you work at…. = One of a number of sites

Is this site the head office of the organisation?

- Yes
- No

Display this question:
If Is this site the head office of the organisation? = No

Are your head offices based in Wales?

- Yes
- No

Roughly how many people work at this specific site?

- 1 to 9
- 10 to 24
- 25 to 49
- 50 to 249
- 250+

Display this question:
If Can we just check, is the site you work at…. = One of a number of sites

How many people work across the business as a whole?

- 0 to 9
- 10 to 49
- 50 to 249
- 250 to 499
- 500 to 749
- 750 to 999
- 1000+

What sector would you say your business operates in?

- Agriculture, forestry and fishing
- Mining and quarrying
- Manufacturing
- Electricity, gas, steam and air conditioning supply
- Water supply; sewerage, waste management and remediation activities
- Construction
- Wholesale and retail trade; repair of motor vehicles and motorcycles
- Transportation and storage
- Accommodation and food service activities
- Information and communication
- Financial and insurance activities
- Real estate activities
- Professional, scientific and technical activities
- Administrative and support service activities
- Public administration and defence; compulsory social security
- Education
- Human health and social work activities
- Arts, entertainment and recreation
- Other service activities
- None of the above
-

Display this question:
If What sector would you say your business operates in? = None of the above

What does your business do? What goods or services does it provide?

Approximately how old is the building at the site you are based at?
If there are multiple buildings at your site please answer for the building most people work in:

- Less than 10 years old (built after 2010)
- 10 to 20 years old (built between 2000 and 2009)
- 20 to 40 years old (built between 1980 and 1999)
- 40 to 60 years old (built between 1960 and 1979)
- 60 to 100 years old (built between 1920 and 1959)
- Over 100 years old (built before 1920)
- Don't know

What is the tenure of the building at the site you are based at?

- Owned
- Rented
- Don't know

On a scale of 1–5 (where 1 = ‘there are no risks’ and 5 = ‘there are considerable risks’), to what extent do you believe your business is at risk from the effects of climate change?

There are no risks to my business at all				There are considerable risks to my business
1	2	3	4	5

Which of the statements below best describes your company’s assessment of current and future risks of climate change?

- ○ There are no risks to my business at all, so we have not carried out a risk assessment
- ○ We are concerned about possible risks, but we have not assessed them yet
- ○ A risk assessment is in progress
- ○ Periodic risk assessments are conducted
- ○ Periodic risk assessments are conducted and we are implementing solutions

Display this question:
If Which of the statements below best describes your company’s assessment of current and future risk... = We are concerned about possible risks, but we have not assessed them yet
Or Which of the statements below best describes your company’s assessment of current and future risk... = A risk assessment is in progress
Or Which of the statements below best describes your company’s assessment of current and future risk... = Periodic risk assessments are conducted
Or Which of the statements below best describes your company’s assessment of current and future risk... = Periodic risk assessments are conducted and we are implementing solutions

On a scale of 1–5 (where 1 = ‘not at all’ and 5 = ‘to a great extent’), to what extent do you believe your business is at risk of reduced productivity due to increased working temperatures?

Not at all				To a great extent
1	2	3	4	5

Display this question:
If Which of the statements below best describes your company’s assessment of current and future risk... = We are concerned about possible risks, but we have not assessed them yet
Or Which of the statements below best describes your company’s assessment of current and future risk... = A risk assessment is in progress
Or Which of the statements below best describes your company’s assessment of current and future risk... = Periodic risk assessments are conducted
Or Which of the statements below best describes your company’s assessment of current and future risk... = Periodic risk assessments are conducted and we are implementing solutions

Please explain what risks you perceive there to be to productivity due to increased working temperatures.

Display this question:
If Which of the statements below best describes your company's assessment of current and future risk... = We are concerned about possible risks, but we have not assessed them yet
Or Which of the statements below best describes your company's assessment of current and future risk... = A risk assessment is in progress
Or Which of the statements below best describes your company's assessment of current and future risk... = Periodic risk assessments are conducted
Or Which of the statements below best describes your company's assessment of current and future risk... = Periodic risk assessments are conducted and we are implementing solutions

On a scale of 1–5 (where 1 = 'not at all' and 5 = 'to a great extent'), to what extent do you believe your business is at risk of reduced productivity due to infrastructure disruption *(e.g. road/rail disruption, power outages or disrupted internet connection)* as a result of <u>increased temperatures</u>?

NB: In this research exercise, we are not interested in disruption to infrastructure due to other extreme weather events such as storms and flooding.

Not at all			To a great extent	
1	2	3	4	5

Display this question:
If Which of the statements below best describes your company's assessment of current and future risk... = We are concerned about possible risks, but we have not assessed them yet
Or Which of the statements below best describes your company's assessment of current and future risk... = A risk assessment is in progress
Or Which of the statements below best describes your company's assessment of current and future risk... = Periodic risk assessments are conducted
Or Which of the statements below best describes your company's assessment of current and future risk... = Periodic risk assessments are conducted and we are implementing solutions

Please explain what risks you perceive there to be to productivity due to infrastructure disruption as a result of <u>increased temperatures</u>.

Display this question:
If Which of the statements below best describes your company's assessment of current and future risk... = We are concerned about possible risks, but we have not assessed them yet
Or Which of the statements below best describes your company's assessment of current and future risk... = A risk assessment is in progress
Or Which of the statements below best describes your company's assessment of current and future risk... = Periodic risk assessments are conducted
Or Which of the statements below best describes your company's assessment of current and future risk... = Periodic risk assessments are conducted and we are implementing solutions

Climate change adaptation means identifying potential adverse effects of climate change and taking appropriate measures to prevent or minimise the risk posed to the business by climate change.

Display this question:
If Which of the statements below best describes your company's assessment of current and future risk... = We are concerned about possible risks, but we have not assessed them yet
Or Which of the statements below best describes your company's assessment of current and future risk... = A risk assessment is in progress
Or Which of the statements below best describes your company's assessment of current and future risk... = Periodic risk assessments are conducted
Or Which of the statements below best describes your company's assessment of current and future risk... = Periodic risk assessments are conducted and we are implementing solutions

Which of the statements below best describes your company's engagement with climate change adaptation?

- My business has implemented or is in the process of implementing a climate change adaptation plan
- My business does not have a climate change adaptation plan but we are thinking about adopting one
- My business is likely to introduce a climate change plan, but we have not thought about it
- My business has thought about introducing a climate change adaptation plan and decided not to introduce one
- This is not something we have thought about
- Don't know

Display this question:
If Which of the statements below best describes your company's engagement with climate change adapta... = My business does not have a climate change adaptation plan but we are thinking about adopting one
Or Which of the statements below best describes your company's engagement with climate change adapta... = My business is likely to introduce a climate change plan, but we have not thought about it

You said ***"${Q20/ChoiceGroup/SelectedChoices}"***. Which of the following best describes your business' ability to draw up and implement a climate change adaptation plan?

- We would be able to draw up and implement a climate change adaptation plan without making use of external support
- We would need to make use of external support to draw up our climate change adaptation plan

Display this question:
If You said "${q://QID15/ChoiceGroup/SelectedChoices}". Which of the following best describes your b... = We would need to make use of external support to draw up our climate change adaptation plan

What support would you need to draw up a climate change adaptation plan?

Display this question:
If Which of the statements below best describes your company's engagement with climate change adapta... = My business does not have a climate change adaptation plan but we are thinking about adopting one
Or Which of the statements below best describes your company's engagement with climate change adapta... = My business is likely to introduce a climate change plan, but we have not thought about it

What are the main barriers preventing you from putting an adaptation plan in place?

- Capacity gaps within the organisation
- Uncertainty about what the risks will actually be
- Lack of information about how climate change risks affect my business/sector specifically
- Limited local information about climate change risks for my area
- Uncertainty about how to develop a plan
- Insufficient financial resources
- The issues are not of sufficient importance to the business
- Other

Display this question:
If Which of the statements below best describes your company's engagement with climate change adapta... = My business has thought about introducing a climate change adaptation plan and decided not to introduce one

You said that your business had considered implementing a climate change adaptation plan but decided not to. Why did your business decide not to?

Who do you identify as having responsibility for ensuring that businesses adapt to the effects of climate change, specifically the impact of higher working temperatures and infrastructure disruption on worker productivity?

- Businesses
- Devolved Government
- Central Government
- Local Authorities
- Sector representative organisations
- Specialist business support organisations
- Other

Display this question:
If Who do you identify as having responsibility for ensuring that businesses adapt to the effects of... = Other

Please specify who else you identify as having responsibility for ensuring that businesses adapt to the effects of climate change, specifically the impact of higher working temperatures and infrastructure disruption on worker productivity.

Display this question:
If Which of the statements below best describes your company's engagement with climate change adapta... = My business has implemented or is in the process of implementing a climate change adaptation plan

Earlier, you said your business has implemented or is in the process of implementing a climate change adaptation plan. Which of the following best describes how your business was able to draw up and implement its climate change adaptation plan?

- We were able to draw up and implement a climate change adaptation plan without making use of external support
- We made use of external support to draw up our climate change adaptation plan

Display this question:
If Earlier, you said your business has implemented or is in the process of implementing a climate ch... = We made use of external support to draw up our climate change adaptation plan

Please specify what that support was.

Display this question:
If Which of the statements below best describes your company's engagement with climate change adapta... = My business has implemented or is in the process of implementing a climate change adaptation plan

Was there any additional information or support you would have liked to have had when you were drawing up and implementing your climate change adaptation plan?

Display this question:
If Which of the statements below best describes your company's engagement with climate change adapta... = My business has implemented or is in the process of implementing a climate change adaptation plan

What were the main drivers for your business adopting a climate change adaptation plan?

Display this question:
If Which of the statements below best describes your company's engagement with climate change adapta... = My business has implemented or is in the process of implementing a climate change adaptation plan

Were there individuals within your organisation who were the main drivers for your business adopting a climate change adaptation plan? If so, who were they?
(NB: We are interested in their job roles, not their names)

Display this question:
If Which of the statements below best describes your company's engagement with climate change adapta... = My business has implemented or is in the process of implementing a climate change adaptation plan

Thinking specifically about your adaptation plan's approach to reducing the risk of reduced productivity due to higher working temperatures, what measures — if any — have you planned and put in place?

	Planned	Put in place	N/A
Air conditioning	○	○	○
Mechanisation	○	○	○
Outdoor shade	○	○	○
Increased thermal mass for materials used in the workplace	○	○	○
Green roofs	○	○	○
Increased roof/wall albedo (using more white/reflective surfaces so that buildings absorb less heat)	○	○	○
Reduced internal gains (lighting)	○	○	○
Reduced internal gains (heat-outputting devices, e.g. ovens, electronics, furnaces)	○	○	○
Increased ventilation	○	○	○
Relocating business (or certain activities) to a new site/building	○	○	○
Early heat warning systems	○	○	○
Education and awareness campaigns on risk of heat	○	○	○
Worker practice and monitoring measures (e.g. rest, scheduling and acclimatisation regimes, biophysical monitoring and other related measures)	○	○	○
Changing working hours	○	○	○
Changing worker clothing	○	○	○
Spatial zoning of working areas to avoid parts of the site that receive direct solar radiation	○	○	○
Other [please specify]	○	○	○

Display this question:
If Thinking specifically about your adaptation plan's approach to reducing the risk of reduced produ... = Other [please specify] [Planned]
Or Thinking specifically about your adaptation plan's approach to reducing the risk of reduced produ... = Other [please specify] [Put in place]

Please specify what other measures you have put in place

Display this question:
If Which of the statements below best describes your company's engagement with climate change adapta... = My business has implemented or is in the process of implementing a climate change adaptation plan

Does your business' climate change adaptation plan identify risks due to infrastructure disruption as a result of higher temperatures?

- Yes
- No
- Don't know

Display this question:
If Which of the statements below best describes your company's engagement with climate change adapta... = My business has implemented or is in the process of implementing a climate change adaptation plan

Which of the following infrastructures are included in this climate change adaptation plan?

- Energy (inc. electricity)
- Road transport
- Rail transport
- Air transport
- Green/blue infrastructure
- ICT
- Internet/telecommunications
- Water/sewerage
- Business supply chain infrastructure (10)
- Other

Display this question:
If Which of the following infrastructures are included in this climate change adaptation plan? = Other

Please specify what other infrastructures are included in this climate change adaptation plan.

Display this question:
If Does your business' climate change adaptation plan identify risks due to infrastructure disruptio... = Yes

Thinking specifically about your adaptation plan's approach to reducing the risk of reduced productivity due to infrastructure disruption, what measures — if any — have you planned and put in place?

	Planned	Put in place	N/A
Encouraging staff to work from home during warm weather	○	○	○
Changes to supply chains	○	○	○
Investment in backup technology (e.g. generators)	○	○	○
Changes to telecoms/communications system	○	○	○
Incorporating considerations about infrastructure disruption into procurement practice	○	○	○
Changes to energy use patterns	○	○	○
Changes to operational practices to reduce risk of disruption to business productivity	○	○	○
Other [please specify]	○	○	○

Display this question:
If Thinking specifically about your adaptation plan's approach to reducing the risk of reduced produ... = Other [please specify] [Planned]
Or Thinking specifically about your adaptation plan's approach to reducing the risk of reduced produ... = Other [please specify] [Put in place]

Please specify:

On a scale of 1–5 (where 1 = 'not at all' and 5 = 'to a great extent'), to what extent has your business suffered from reduced productivity as a result of higher working temperatures during the last 5 years?

Not at all			To a great extent	
1	2	3	4	5

On a scale of 1–5 (where 1 = ‘not at all’ and 5 = ‘to a great extent’), to what extent has your business suffered from reduced productivity as a result of infrastructure disruption during the last 5 years?

Not at all			To a great extent	
1	2	3	4	5

Would you be willing to be contacted by Wavehill to discuss these issues further?

- Yes
- No

Welsh Government is considering putting together a panel to gather further insight from businesses into these issues. Would you be interested in being part of this panel if Welsh Government goes ahead with it?

- Yes
- No

Would you like to be part of the prize draw for one of five £50 donations to be made to a charity of your choice?

- Yes
- No

Display this question:
If Would you like to be part of the prize draw for one of five £50 donations to be made to a charity... = Yes

If successful, what charity would you like us to make a donation to?

Display this question:
If Would you be willing to be contacted by Wavehill to discuss these issues further? = Yes
Or Welsh Government is considering putting together a panel to gather further insight from businesse... = Yes
Or Would you like to be part of the prize draw for one of five £50 donations to be made to a charity... = Yes

Please could you provide us with the following information:

- Business name: _____
- Contact name: _____
- Email: _____
- Telephone number: _____

Follow-Up Interviews

This interview is taking part as part of a research project that Wavehill is conducting (on behalf of the Welsh Government) to identify businesses' readiness for higher working temperatures and infrastructure disruption as a result of climate change. You have been contacted because you completed a survey, online or over the telephone, during which you indicated that you would be interested in participating in a follow-up interview. The purpose of these interviews is to develop a better understanding of what barriers businesses face when implementing measures to mitigate the risks of reduced worker productivity due to higher working temperatures and infrastructure disruption. We would also like to develop a series of case studies based on the interviews, showing what businesses could do to develop climate change adaptation plans which mitigate the risks of reduced productivity due to increased working temperatures and infrastructure disruption and the barriers currently preventing businesses from doing so. We appreciate that this is a difficult time for businesses, who are adapting to operating under difficult circumstances due to COVID-19. We would like to reiterate that this is a voluntary interview and you are under no obligation to take part.

The UK's independent Climate Change Committee carried out a risk assessment in 2017 which found that more research is needed to understand the potential impact of higher temperatures on businesses in Wales. It is thought that businesses may be at risk of disruption to ICT, power and transport infrastructure, preventing workers accessing premises or working remotely, and that higher temperatures may impact on employee safety and productivity, but there is no evidence base to show whether this is, or is not, a risk. This research will identify what the risk is and how ready Welsh businesses are to adapt. It will then be used by Welsh Government to identify how best to support businesses to make these changes.

Participation in this interview is, of course, optional and should take around 15–20 minutes to complete.

If you wish, you can find out more about your rights under GDPR and how the data you provide will be used by Wavehill and Welsh Government in the privacy notice for this project, which is available here. For more information about the study please feel free to contact Tom Marshall at Wavehill (tom.marshall@wavehill.com) or Isabella Malet-Lambert at Welsh Government (isabella.malet-lambert@gov.wales).

Q2 Could we just check the following?

	Yes	No
Are you happy to proceed with the interview?		
Are you happy for a case study to be produced based on the interview? *Please note that if we produce a case study, we will provide you with opportunity to review the case study for approval prior to submitting it to Welsh Government*		
Can we name your business in a case study? *If not, we will produce an anonymised case study using only relevant details (region of Wales and business activity, e.g. "a medium-sized retail business in West Wales")*		
Are you happy for agreed quotes to be used by Welsh Government in marketing and communications activity?		

Introduction

Q4 By way of introduction, could you please describe your company. For example, where is it located? How long have you been operating for? What sector does it work in? What are the main products or services it offers?

Q5 To start with, we just want to check some of the information you provided to us previously. You said when you spoke to us previously that you had ${e://Field/employ} people working for the company across ${e://Field/Site}. Can I just check, is this correct?

- Yes
- No

Display this question:
If 1. To start with, we just want to check some of the information you pr = No

Q6 Please could you provide us with the correct information:

Q7 You also said that your site is ${e://Field/What%20is%20the%20tenure%20of%20the%20building%20at%20the%20site%20you%20are%20based%20at%3F} and the building was built ${e://Field/BuildingAge}. Can I just check, is this correct?

- Yes
- No

Display this question:
If You also said that your site is ... = No

Q8 Please could you provide us with the correct information:

Q9 **Developing a climate change adaptation plan:**

Q10 What, in your view, would be the benefits of having a climate change adaptation plan?

Q11 What, in your view, would be the drawbacks of having a climate change adaptation plan?

Display this question:
If DECIDERS = LT
Or DECIDERS = LN

Q12 You said previously that you were interested in developing a climate change adaptation plan but that you have not yet done so. Can you please tell us more about why you are interested in doing this?

Display this question:
If DECIDERS = LT
Or DECIDERS = LN

Q13 Were there any particular events or circumstances that led you to develop this interest?

Display this question:
If DECIDERS = LT
Or DECIDERS = LN

Q14 Is there a time when you think your business would have benefitted from having an adaptation plan?

Display this question:
If DECIDERS = LN
Or DECIDERS = LT

Q15 If you can comment, why have you not developed a climate change implementation plan yet?

Display this question:
If DECIDERS = LT

Q17 What, if any, challenges are you facing in developing your climate change action plan?

Display this question:
If DECIDERS = LT

Q19 Do you know who within your organisation will have responsibility for this?

- Yes
- No

Display this question:
If Do you know who within your organisation will have responsibility for this? = Yes

Q20 Who will this be?
Note: We are interested in job roles rather than names

Display this question:
If DECIDERS = LN
Or DECIDERS = LT

Q21 You said previously that you ${e://Field/Support} when drawing up your action plan.

Display this question:
If Support = would need support

Q22 Can you tell us a little bit more about what support you feel you need?

Display this question:
If Support = would need support

Q24 Do you know who you would be able to receive support from? If so, who would you hope to access support from?
For example, Welsh Government? A specialist business support organisation?

Display this question:
If Support = would not need support

Q25 What internal expertise would you use to develop the plan?

Display this question:
If DECIDERS = LN
Or DECIDERS = LT

Q26 Do you have a rough idea of what kinds of measures/infrastructure the plan is likely to include?

- Yes
- No

Display this question:
If Do you have a rough idea of what kinds of measures/infrastructure the plan is likely to include? = Yes

Q27 Can you tell us a little bit more about what it will include?

Display this question:
If DECIDERS = LN
Or DECIDERS = LT
And If What is the tenure of the building at the site you are based at? = Rented

Q28 You said previously that the site you work at is rented. Will this pose any problems for you in terms of developing mitigation measures for higher temperatures in your adaptation plan?

Display this question:
If DECIDERS = DN

Q29 You said previously that your business had thought about introducing a climate change adaptation plan and decided not to introduce one. Can you please tell us more about why you decided not to?
Who within your organisation made the decision whether to develop an adaptation plan? Did you receive any advice or support when making this decision? If so, what? Is there a time when you think a climate change adaptation plan might have been beneficial to your organisation?

Display this question:
If DECIDERS = DN

Q42 Is there anything that would make your organisation change this decision? Do you think it is something you would consider again in the future?

Display this question:
If DECIDERS = NT

Q30 You said previously that you have not thought about developing a climate change adaptation plan? What — if anything — would make you think about whether or not to develop a climate change adaptation plan?
For example, more information about the risks of reduced productivity due to higher working temperatures and infrastructure disruption? Examples of what other businesses have done to draw up adaptation plans?

Display this question:
If DECIDERS = NT

Q31 What information or guidance would you need to make a decision about whether to develop an adaptation plan?

Q33 Who, in your view, has primary responsibility for ensuring that businesses make decisions that allow them to mitigate the risks of reduced productivity due to higher working temperatures and infrastructure disruption? Why do you say this?

Q34 Is there anything you were expecting to be asked about today that has not been raised? Is there anything additional you would like to say about your adaptation plan?

Thank you for taking the time to complete this survey.

Case Study Discussion Guide

Impacts of higher working temperatures and infrastructure disruption on business productivity research

This interview is taking part as part of a research project that Wavehill is conducting (on behalf of the Welsh Government) to identify businesses' readiness for higher working temperatures and infrastructure disruption as a result of climate change. You have been contacted because you completed a survey, online or over the telephone, during which you indicated that you would be interested in participating in a follow-up interview. We appreciate that this is a difficult time for businesses, who are adapting to operating under difficult circumstances due to COVID-19. We would like to reiterate that this is a voluntary interview and you are under no obligation to take part.

The purpose of these interviews is to develop a better understanding of what businesses are doing to mitigate the risks of reduced worker productivity due to higher working temperatures and infrastructure disruption. We would also like to develop a series of case studies based on the interviews, showing what businesses in different sectors can do to mitigate these risks. The UK's independent Climate Change Committee carried out a risk assessment in 2017 which found that more research is needed to understand the potential impact of higher temperatures on businesses in Wales. It is thought that businesses may be at risk of disruption to ICT, power and transport infrastructure, preventing workers accessing premises or working remotely, and that higher temperatures may impact on employee safety and productivity, but there is no evidence base to show whether this is, or is not, a risk. This research will identify what the risk is and how ready Welsh businesses are to adapt. It will then be used by Welsh Government to identify how best to support businesses to make these changes.

Participation in this interview is, of course, optional and should take around 30 minutes to complete.

If you wish, you can find out more about your rights under GDPR and how the data you provide will be used by Wavehill and Welsh Government in the privacy notice for this project, which is available here. For more information about the study please feel free to contact Tom Marshall at Wavehill (tom.marshall@wavehill.com) or Isabella Malet-Lambert at Welsh Government (isabella.malet-lambert@gov.wales).

	Yes	No
Are you happy to proceed with the interview?		
Are you happy for a case study to be produced based on the interview? *Please note that if we produce a case study, we will provide you with opportunity to review the case study for approval prior to submitting it to Welsh Government*		
Can we name your business in a case study? *If not, we will produce an anonymised case study using only relevant details (region of Wales and business activity, e.g. "a medium-sized retail business in West Wales")*		
Are you happy for agreed quotes to be used by Welsh Government in marketing and communications activity?		

Questions and points for discussion:

Introduction:

1. By way of introduction, could you please describe your company. *For example, where is it located? How long have you been operating for? What sector does it work in? What are the main products or services it offers?*

2. You said when you spoke to us previously that you had **<seed in answer from previous survey>** people working for the company across **<seed in answer from previous survey>** sites. Can I just check, is this correct?

3. You also said that your site is **<seed in answer from previous survey>** and the building was built in **<seed in answer from previous survey>**. Can I just check, is this correct?

Developing your adaptation plan:

4. You said previously that **<seed in answer from previous survey>** were the key reasons for developing your adaptation plan. Can you please tell us more about this?
    a. Were there any particular events or circumstances that led you to develop an adaptation plan?

5. You said that **<seed in answer from previous survey>** were the key personnel involved in developing the action plan. Is this correct?

6. What, if any, challenges did you face in developing your climate change action plan?
    a. How successful, if at all, were you in overcoming those?

7. You said that you used **<seed in answer from previous survey>** external support/did not use external support when drawing up your action plan.
    a. If used support = yes. Can you tell us a little bit more about the support that you used? Who provided it?
    b. If used support = yes. How easy was it to get this support? Did you feel there was anything lacking from this support? Any questions you needed answering?
    c. If used support = no. What expertise did you use to develop the plan?
    d. Was there any (additional) support you would have liked to have had access to while developing your adaptation plan?

8. Now that the plan has been developed, who has ownership over/responsibility for the plan?
    a. How regularly is the plan updated?
    b. What do you look at when updating the plan?
    c. Where does the expertise come from to update the plan?
    d. How is the plan integrated into your company's overall strategic business plan?
    e. How is information about the plan disseminated within your organisation? Is everyone within the organisation aware of it and its contents, or only key members of staff?

Adaptation in practice:

9. You said that you have already put **<seed in answer from previous survey>** aspects of your plan in place. Can you please tell us a little bit more about these?

10. What, if anything, did you find easy to implement about the plan?

11. Did you face any particular challenges in doing these things?
    a. Did you have to access any external support to put these things in place? If so, what support did you access?

12. If tenure = rented. You said previously that the site you work at is rented. Has this posed any problems for you in terms of putting parts of your adaptation plan in place?

13. Are there any aspects of this plan that you are planning to put in place in future? Can you please tell us a little bit more about these?

14. Are you facing any challenges to implementing future aspects of your adaptation plan?
    a. Do you require any support to put these things in place, and if so, what might this support look like?

15. Have you had to implement your action plan in response to higher working temperatures/infrastructure disruption? If so, can you please tell us about it?
    a. If 14 = yes. Did this situation lead you to make any changes to your adaptation plan?

16. Is there anything you were expecting to be asked about today that has not been raised? Is there anything additional you would like to say about your adaptation plan?

Annexe B: Sample Frame

6.27 When considering the sample frame for the research, two key factors were taken into consideration: the size and sector of businesses.

6.28 The size of businesses was an important consideration for the sample frame:

- Where scale is important in understanding the likelihood of ownership of premises by a business
- The scale of a business also has a direct relationship with the scale of impact (number of employees) that higher temperatures in working environments may have
- The scale of a business is also likely to be influential in a business having in place suitable mechanisms with which to protect/mitigate the risks of disruption associated with higher temperatures in working environments. It is possible that smaller businesses will be less likely than larger ones to have the resources with which to adapt, including the human resources with which to respond to this problem and individuals with expertise in this area.

6.29 Reflecting this, the primary focus for the research was upon businesses with at least 10 employees and no more than 250, i.e. businesses classified as small (non-micro) and medium-sized businesses.

6.30 The sector of the business was also considered. The nature of the industry in which a business is operating will be influential in the extent to which higher temperatures will be a factor in working environments. It is expected that it will be more influential in manufacturing, finance and business service and administration sectors (typical office environments) as a primary area of focus, with retail and food/accommodation being a secondary focus.

6.31 The sectors have been defined through the use of broad sector sections from Standard Industrial Classification (SIC) codes and are presented in the table overleaf.[24] Those considered a priority for the research have been assigned “1” and are shaded in orange (with those considered a secondary priority assigned “2”).

[24] Standard industrial classification

6.32 Following this, a random sample of businesses was obtained from the priority 1 population to target through telephone interviews and as part of the Qualtrics panel. Consequently, the majority of data used to write this report derives from these sectors. As the survey was circulated via Business Wales CRM, not all responses fit within these parameters.

Industry	Total	Small (10 to 49)	Medium-Sized (50 to 249)	Total Eligible	Priority?
A: Agriculture, forestry and fishing	13,935	175	10	**185**	
B: Mining and quarrying	75	10	5	**15**	
C: Manufacturing	5,850	800	330	**1,130**	1
D: Electricity, gas, steam and air conditioning supply	195	10	5	**15**	
E: Water supply; sewerage, waste management	395	80	15	**95**	
F: Construction	13,490	825	90	**915**	2
G: Wholesale and retail trade; repair of motor vehicles	15,815	1,520	170	**1,690**	2
H: Transportation and storage	4,905	500	60	**560**	2
I: Accommodation and food service activities	8,660	1,815	120	**1,935**	2
J: Information and communication	4,600	205	30	**235**	1
K: Financial and insurance activities	1,855	80	20	**100**	1
L: Real estate activities	2,885	135	25	**160**	1
M: Professional, scientific and technical activities	12,185	740	100	**840**	1
N: Administrative and support service activities	8,185	605	130	**735**	1
O: Public admin & defence; compulsory social security	515	15	10	**25**	1
P: Education	1,365	185	40	**225**	1
Q: Human health and social work activities	4,350	1,310	250	**1,560**	1
R: Arts, entertainment and recreation	2,290	335	50	**385**	2
S: Other service activities	4,470	260	20	**280**	2
Column Total	**106,015**	**9,600**	**1,475**	**11,075**	**5,010**

Annexe C: Additional Research Findings

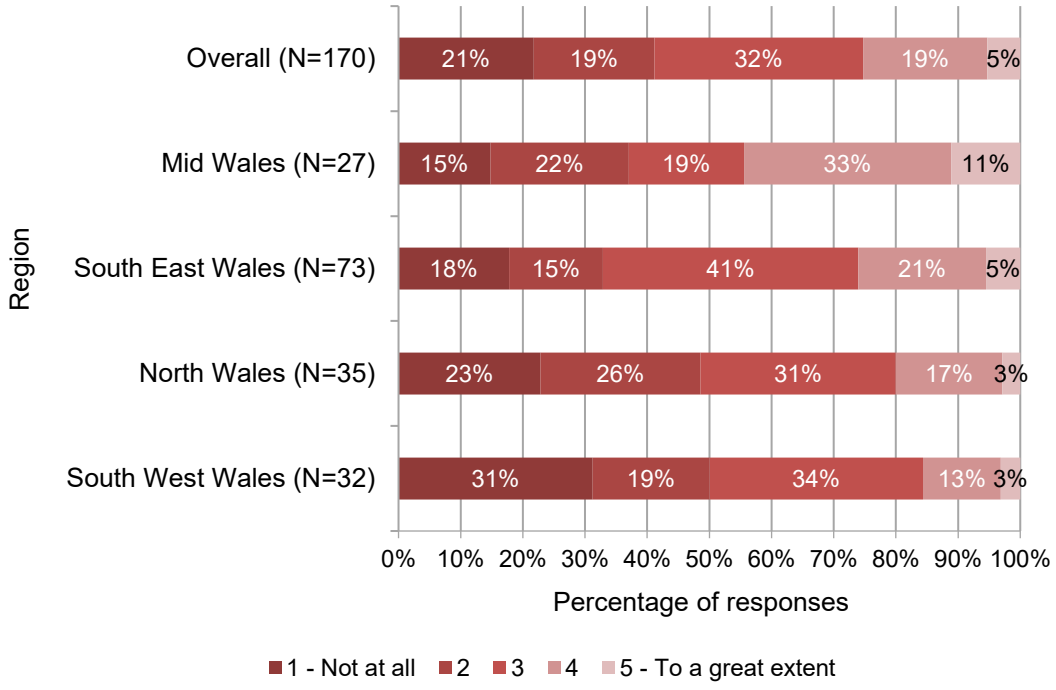
Additional Analysis of Perceptions of Risk

6.33 This section outlines additional analyses of perceptions of risk.

Regional differences in perceptions of risk

6.34 In order to explore regional differences in perceptions of risk, the findings were disaggregated by region of Wales (as defined by Business Wales).[25] As Figure C.1 indicates, businesses in both Mid Wales and South East Wales perceived a higher risk of reduced productivity due to increased working temperatures than the Wales-wide average. Meanwhile, businesses in both North Wales and South West Wales perceived lower risks than the Wales-wide average.

Figure C.1: To what extent do you believe your business is at risk of reduced productivity due to increased working temperatures? (where 1 = 'not at all' and 5 = 'to a great extent') (by region)



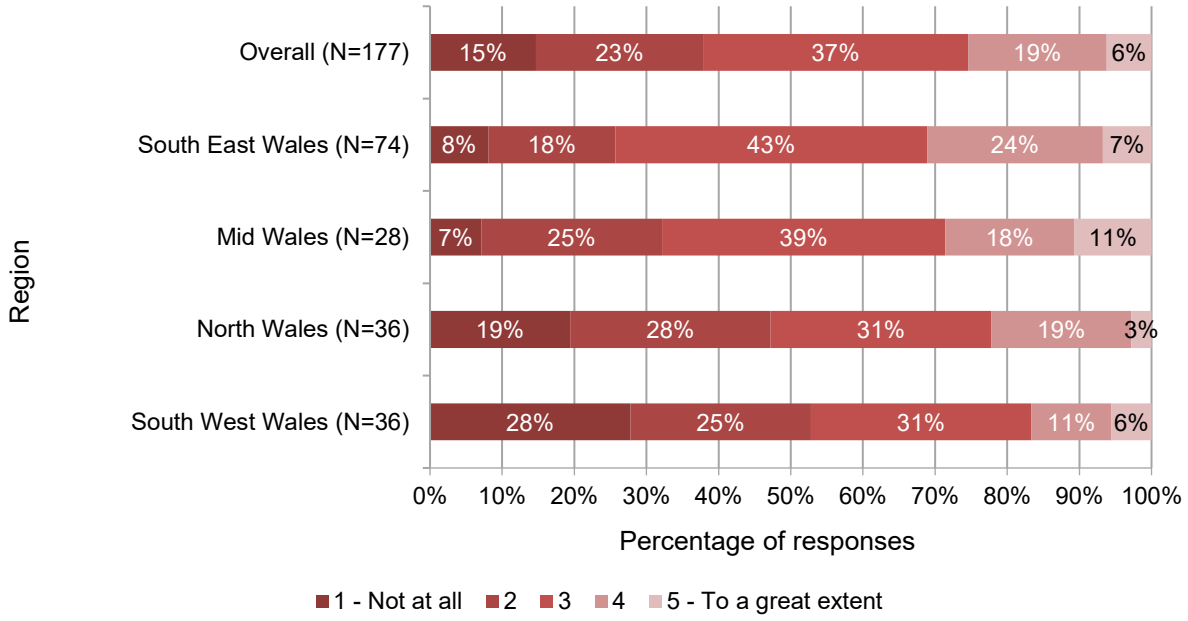
N=170

Source: Business survey

[25] https://businesswales.gov.wales/walesscreen/locations/regions-wales

6.35 As Figure 3.14 indicates, a similar pattern emerged for businesses' perceptions of risks due to infrastructure disruption. Survey respondents from both Mid Wales and South East Wales reported perceiving higher-than-average risks due to infrastructure disruption, while respondents in both North Wales and South West Wales reported lower-than-average risks.

Figure C.2: To what extent do you believe your business is at risk of reduced productivity due to infrastructure disruption (e.g. road/rail disruption, power outages or disrupted internet connection) as a result of increased temperatures? (where 1 = 'not at all' and 5 = 'to a great extent') (by region)



N=177

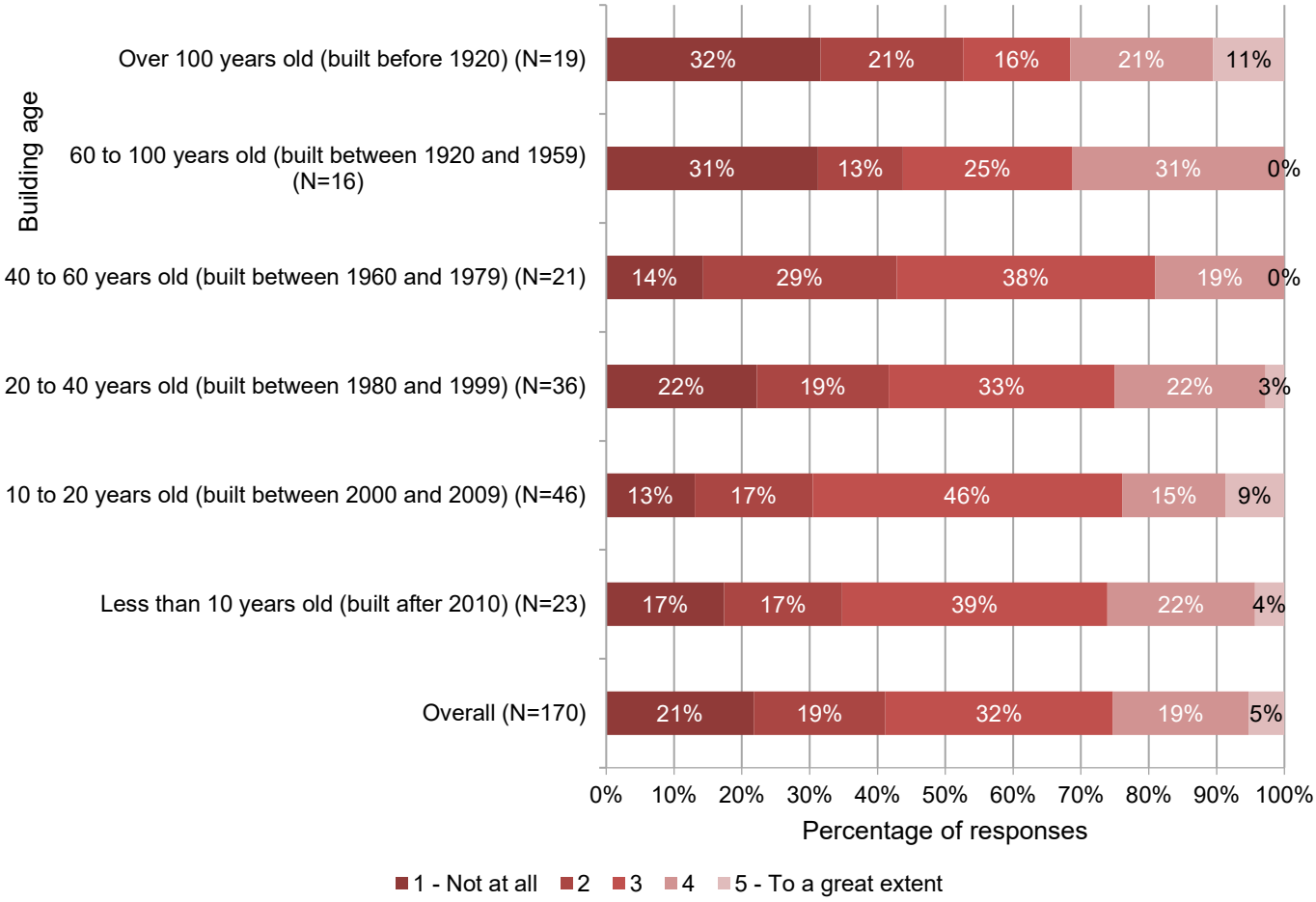
Source: Business survey

Perceived risks disaggregated by building age

6.36 In order to understand whether there was any trend in perceived risks due to increased working temperatures or infrastructure disruption and the age of buildings at the site, crosstabs were compiled of average scores to these two questions broken down by building age.

6.37 Overall, there does not appear to be a relationship between these factors, although it is interesting to note that businesses whose buildings were between 10 and 20 years old were more concerned about these risks than might be expected. This suggests that in comparison to other factors, building age has less of an impact on perceived risks.

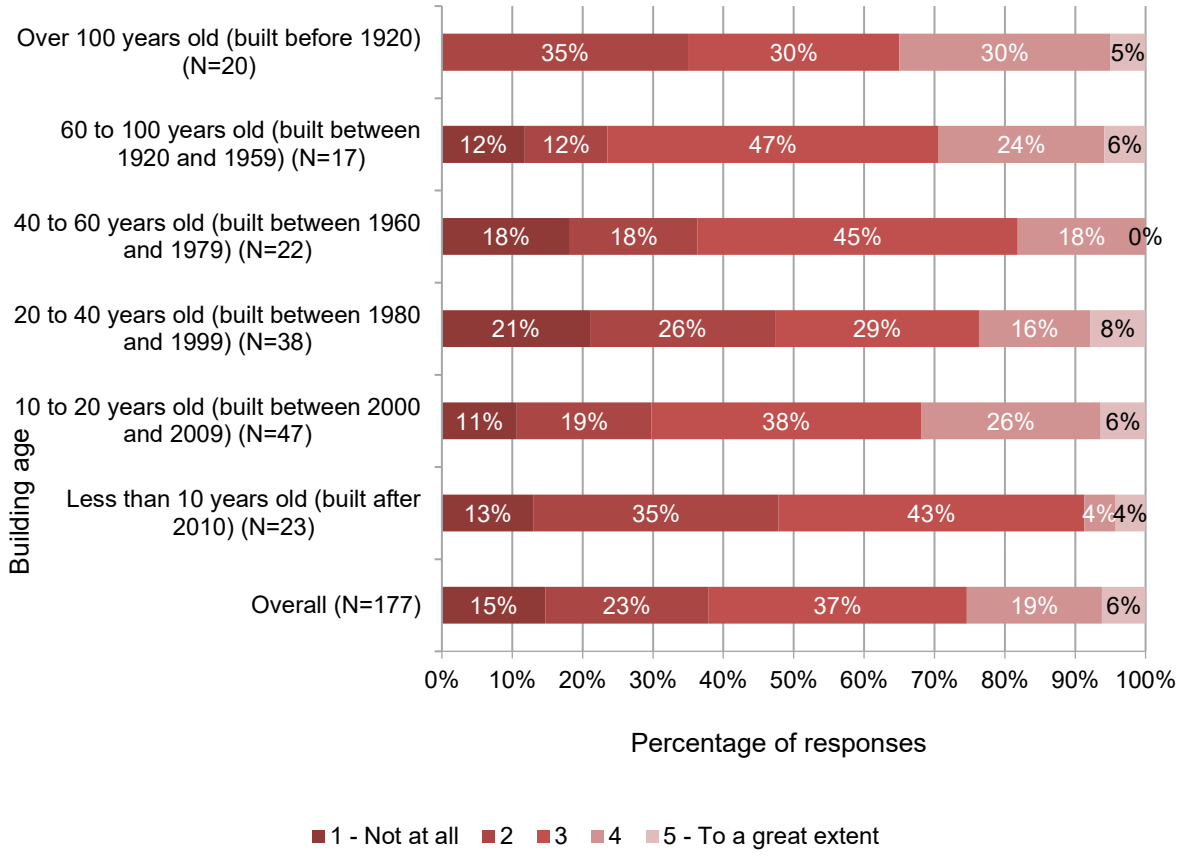
Figure C.3: To what extent do you believe your business is at risk of reduced productivity due to increased working temperatures? (where 1 = 'not at all' and 5 = 'to a great extent') (by building age)



N=170

Source: Business survey

Figure C.4: To what extent do you believe your business is at risk of reduced productivity due to infrastructure disruption (e.g. road/rail disruption, power outages or disrupted internet connection) as a result of increased temperatures? (where 1 = 'not at all' and 5 = 'to a great extent') (by building age)



N=177

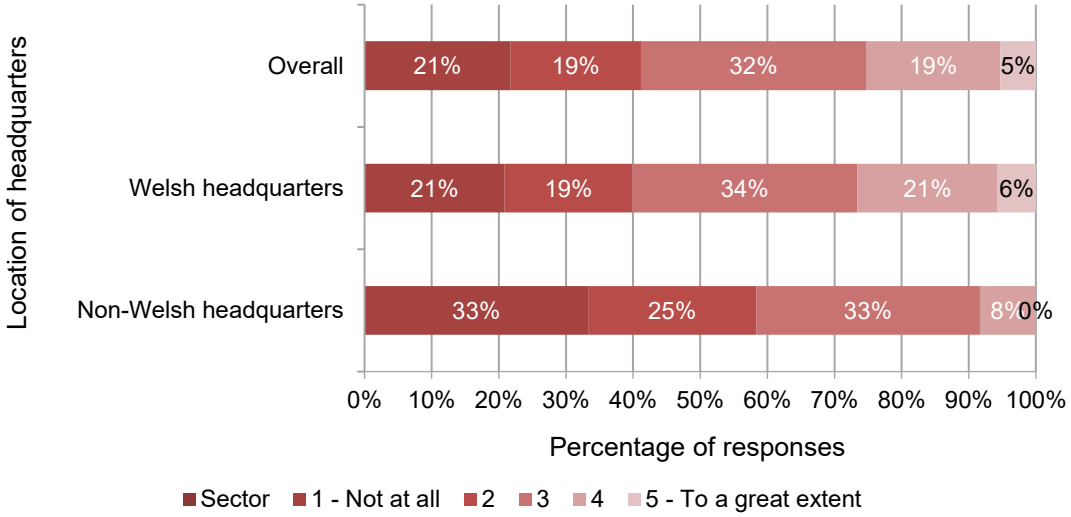
Source: Business survey

Perceived risks disaggregated by location of headquarters

6.38 In order to determine whether the location of the businesses' headquarters had an impact on their perceived risks due to increased working temperatures and infrastructure disruption to their business, the average scores for these two questions were calculated based on whether their headquarters were located in Wales or elsewhere. It is important to note that only 12 respondents stated that their business headquarters were not located in Wales; this small sample size must be taken into consideration and, therefore, caution must be exercised when considering the impact of this factor.

6.39 Wales-headquartered businesses were more likely to perceive risks to their business due to increased working temperatures.

Figure C.5: To what extent do you believe your business is at risk of reduced productivity due to increased working temperatures? (where 1 = 'not at all' and 5 = 'to a great extent') (by headquarters)

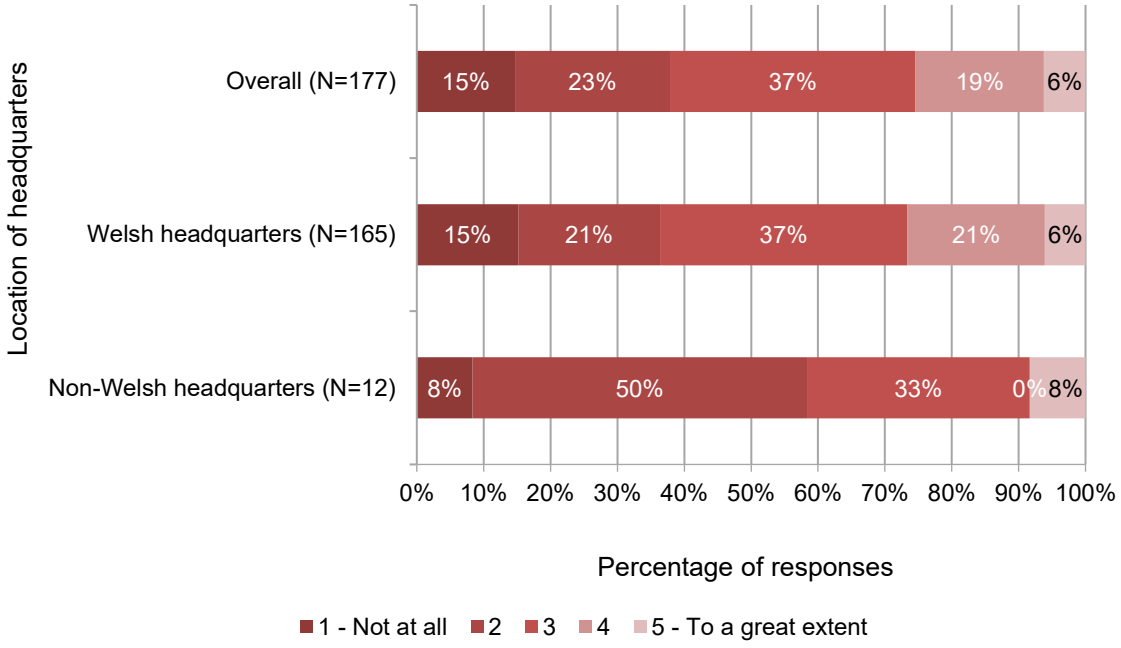


N=170

Source: Business survey

6.40 As Figure C.6 indicates, Wales-headquartered businesses were more likely to perceive risks to their business as a result of infrastructure disruption than were businesses with headquarters elsewhere.

Figure C.6: To what extent do you believe your business is at risk of reduced productivity due to infrastructure disruption (e.g. road/rail disruption, power outages or disrupted internet connection) as a result of increased temperatures? (where 1 = 'not at all' and 5 = 'to a great extent') (by headquarters)



N=177

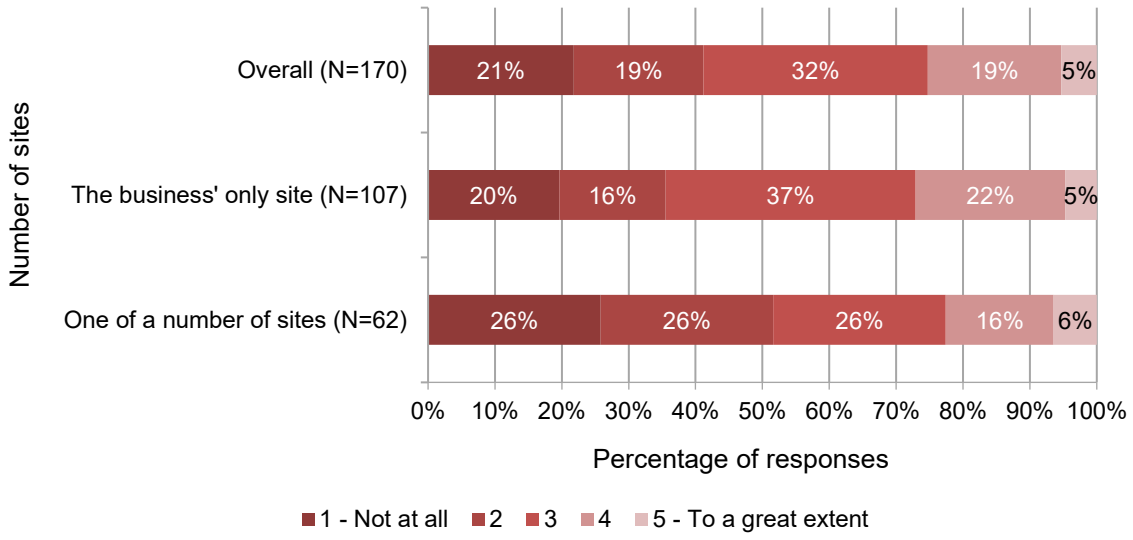
Source: Business survey

Perceived risks disaggregated by number of sites

6.41 To further examine the factors that impact businesses' perceptions of risks, answers to these two questions were categorised by whether or not the business had one or multiple sites.

6.42 On average, businesses with only one site were slightly more likely than both businesses with multiple sites and the overall sample to perceive risks to their business due to increased working temperatures.

Figure C.7: To what extent do you believe your business is at risk of reduced productivity due to increased working temperatures? (where 1 = 'not at all' and 5 = 'to a great extent') (by number of sites)

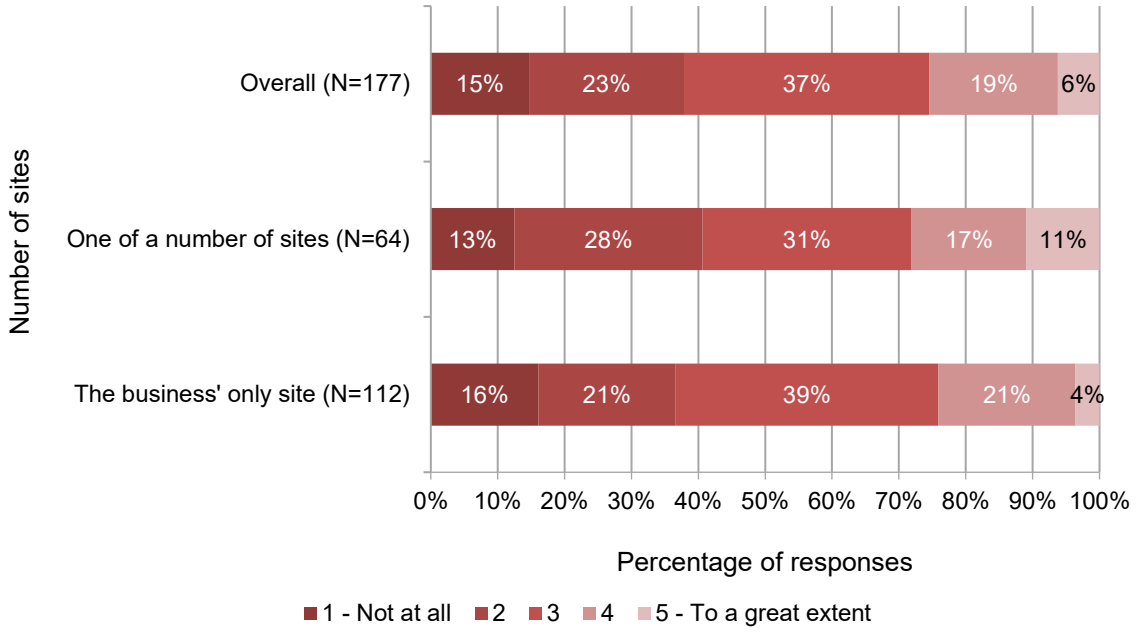


N=169

Source: Business survey

6.43 Conversely, businesses with only one site were slightly more likely than both businesses with multiple sites and the overall sample to perceive risks to their business due to infrastructure disruption. Given that much of the qualitative data with regard to perceived risks as a result of infrastructure disruption related to staff travel, this may explain why this factor would have a greater impact on these businesses.

Figure C.8: To what extent do you believe your business is at risk of reduced productivity due to infrastructure disruption (e.g. road/rail disruption, power outages or disrupted internet connection) as a result of increased temperatures? (where 1 = 'not at all' and 5 = 'to a great extent') (by number of sites)



N=176

Source: Business survey

Additional Analysis of Approaches to Assessing and Acting on Risks

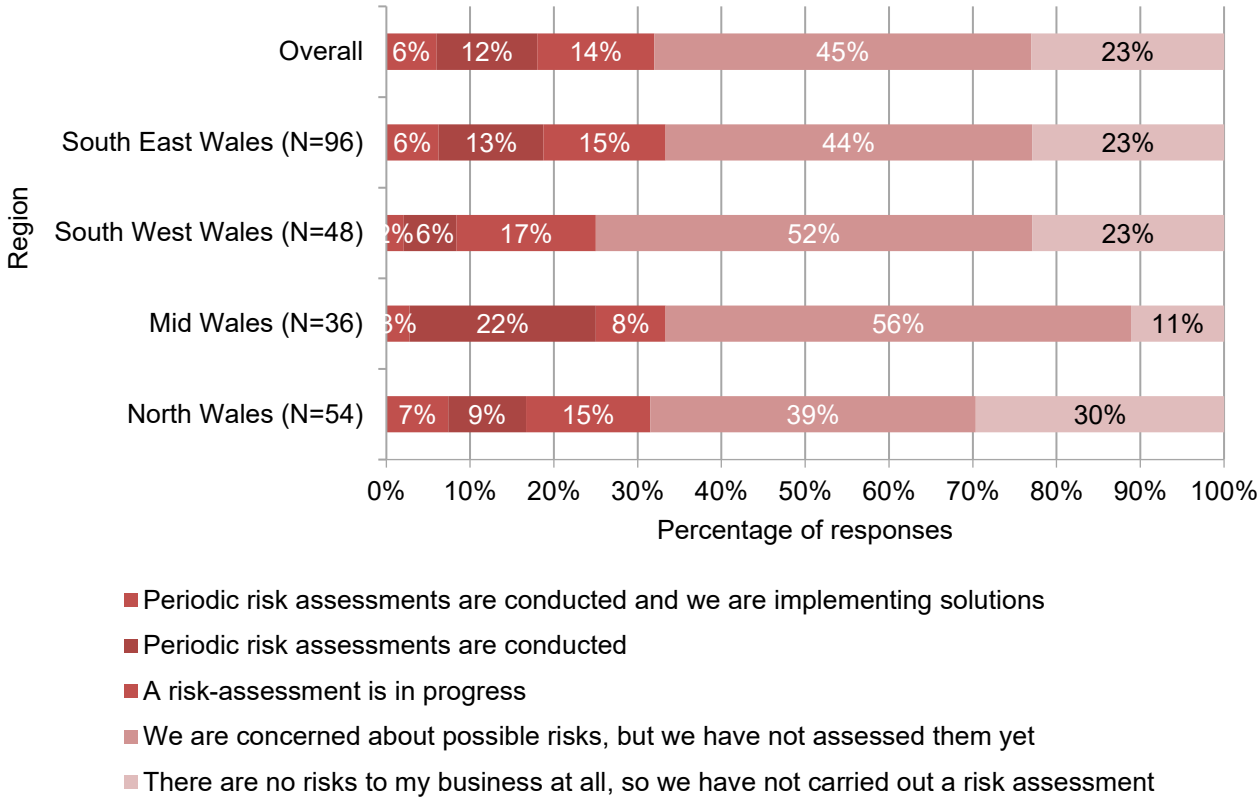
6.44 This section describes additional analyses carried out to explore approaches to assessing and acting on risks.

Regional differences in approaches to assessing and acting on risks

6.45 In order to understand whether there are any regional differences to assessing and acting on risks, data for these questions was broken down by region.

6.46 On average, businesses in both Mid Wales and South East Wales were more likely to perceive risks to their business as a result of both increased working temperatures and infrastructure disruption, and were slightly more likely to be conducting periodic risk assessments and implementing solutions (25%, 9/36 and 19%, 18/96 when both risk assessment answer options are combined).

Figure C.9: Which of the statements below best describes your company's assessment of current and future risks of climate change?

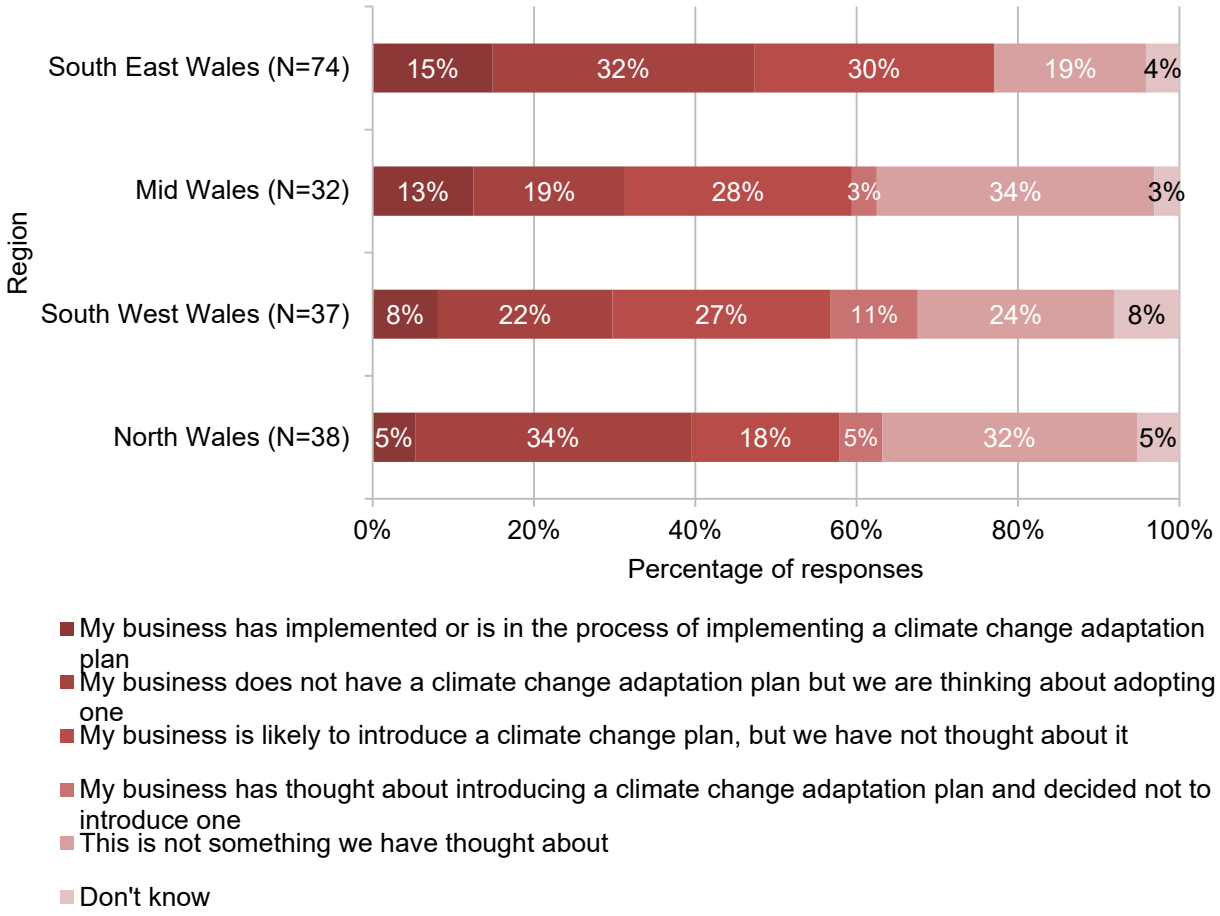


N=234

Source: Business survey

6.47 Similarly, businesses in both South East Wales and Mid Wales were more likely to have implemented or be in the process of implementing a climate change adaptation plan. It is worth noting that although 13% (4/32) of businesses in Mid Wales either had implemented or were in the process of implementing a climate change adaptation plan, over one third of businesses in the region (11/32) had not considered a plan.

Figure C.10: Which of the statements below best describes your company's engagement with climate change adaptation?



N=234

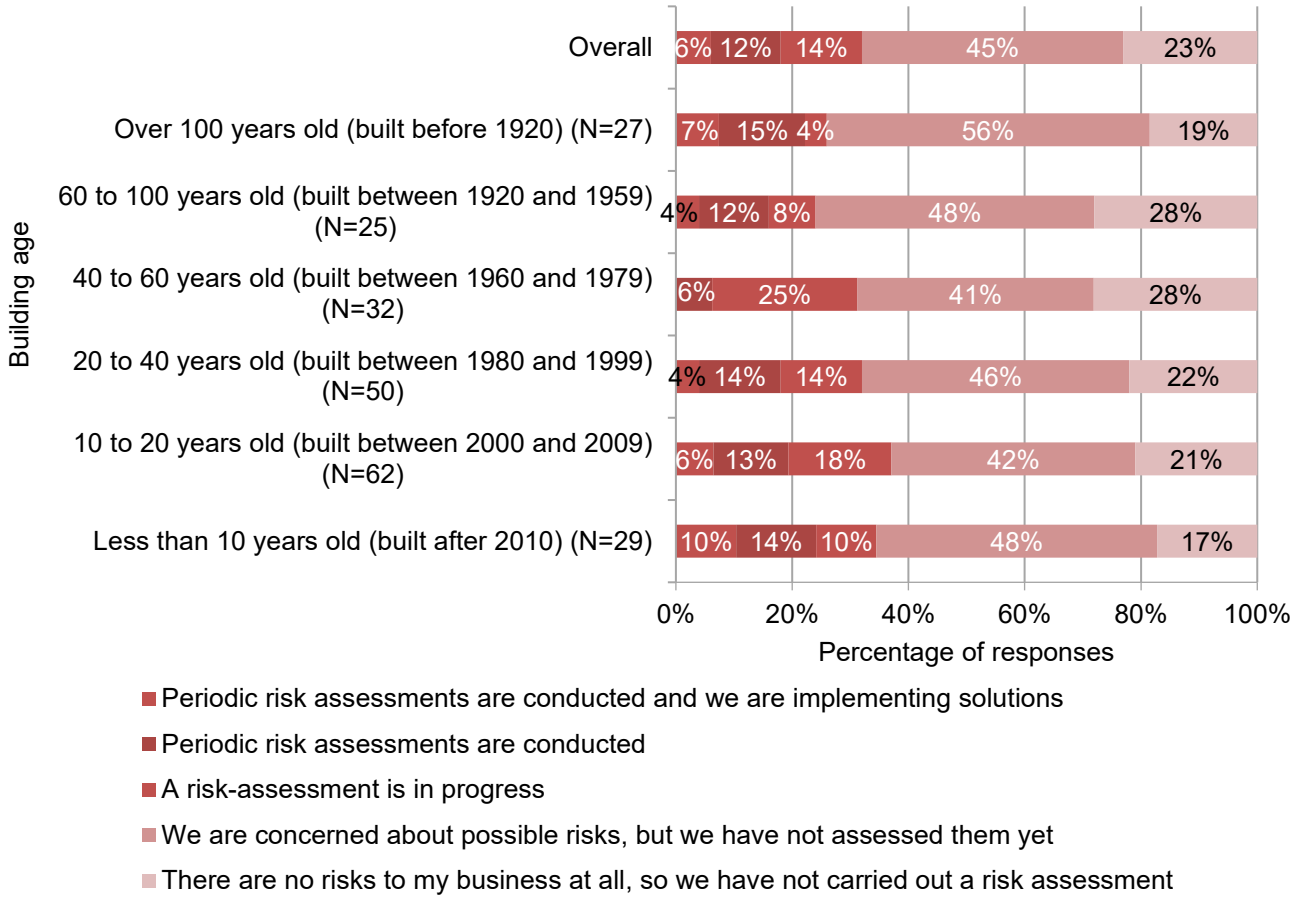
Source: Business survey

Differences in approaches to assessing and acting on risks by building age

6.48 Building age was identified as being a potential variable factor that might impact on businesses' perceptions of risks.

6.49 As with perceptions of risk due to increased working temperatures and infrastructure disruption, there was no apparent relationship between building age and the likelihood of conducting risk assessments.

Figure C.11: Which of the statements below best describes your company's assessment of current and future risks of climate change?

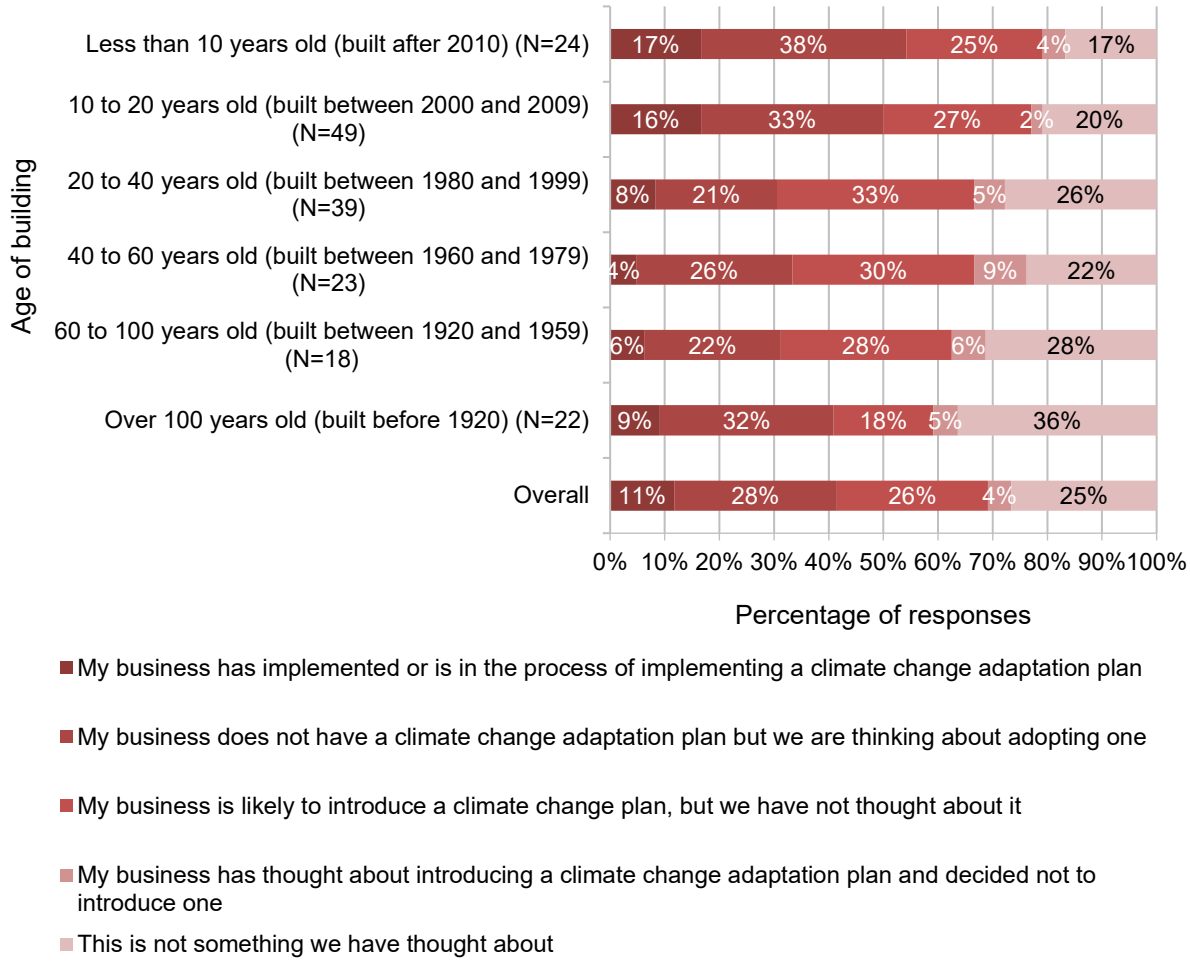


N=225

Source: Business survey

6.50 Interestingly, businesses with buildings that had been built since 2000 were more likely to have implemented or be in the process of implementing a climate change adaptation plan.

Figure C.12: Which of the statements below best describes your company's engagement with climate change adaptation?



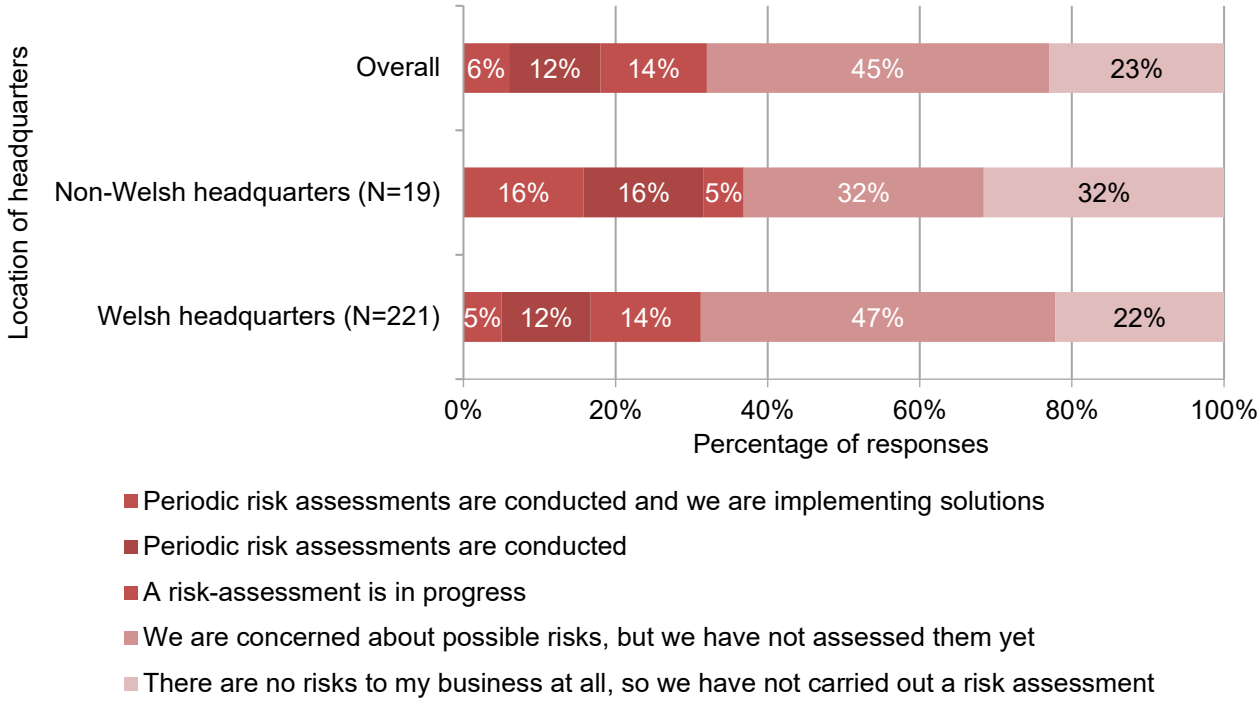
N=175

Source: Business survey

Differences in approaches to assessing and acting on risks by headquarters

6.51 Despite businesses with headquarters located in Wales being more concerned about perceived risks due to increased working temperatures and infrastructure disruption, (overall) a smaller proportion of them were conducting periodic risk assessments. Once again, however, the small sample size for businesses with headquarters located elsewhere must be stressed.

Figure C.13: Which of the statements below best describes your company's assessment of current and future risks of climate change?

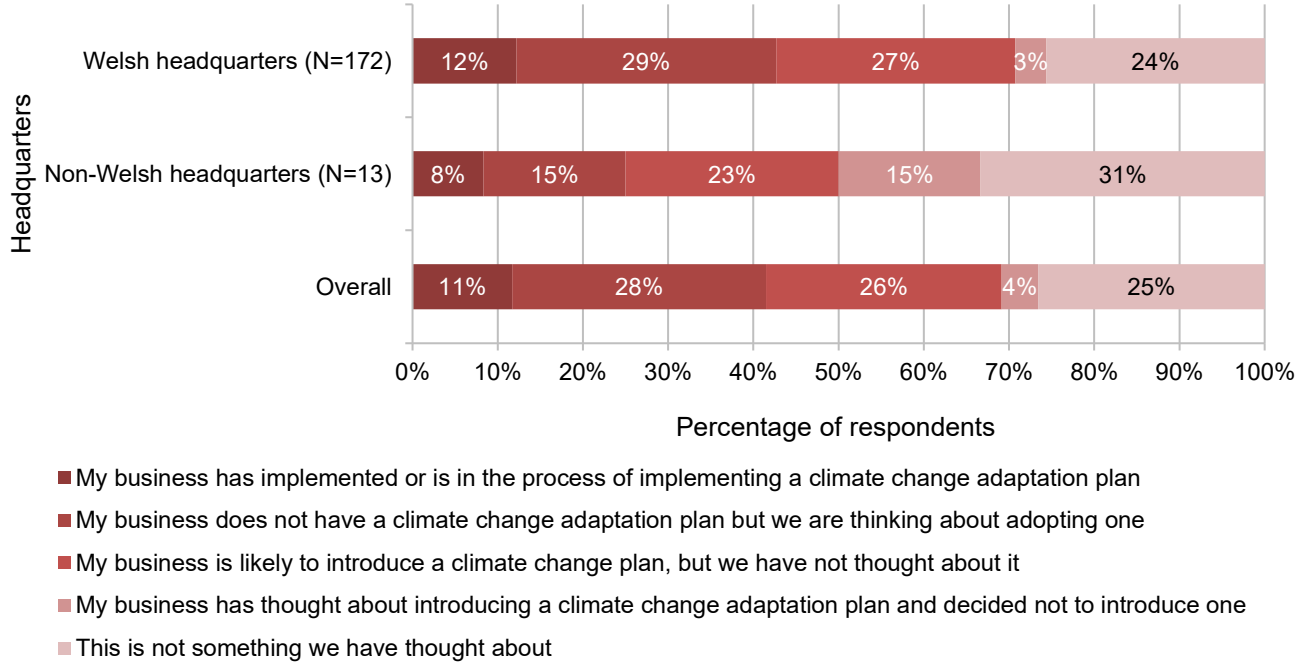


N=240

Source: Business survey

6.52 Wales-headquartered businesses were more likely to have implemented or be in the process of implementing a climate change adaptation plan. Given the lack of a consistent trend in terms of approaches to assessing and acting on risks, it is likely that this factor is not a major impactor on perceptions of risk when compared to others.

Figure C.14: Which of the statements below best describes your company's engagement with climate change adaptation?



N=185

Source: Business survey

Sectoral Differences in Perceptions of Responsibility for Climate Change Adaptation

6.53 This table highlights sectoral differences in perceptions of responsibility for climate change adaptation.

Table C.1: Who do you identify as having responsibility for ensuring that businesses adapt to the effects of climate change? Most popular response by sector

Most popular response	Sector
Businesses	Manufacturing (N=40) Professional, scientific and technical activities (N=23) Construction (N=21) Human health and social work activities (N=20) Financial and insurance activities (N=15) Information and communication (N=14) Arts, entertainment and recreation (N=9) Transportation and storage (N=8) Administrative and support service activities (N=11) Other service activities (N=13)

Most popular response	Sector
Local Authorities	Education (N=17) Accommodation and food service activities (N=17) Wholesale and retail trade; repair of motor vehicles and motorcycles (N=19) Real estate activities (N=3) Mining and quarrying (N=3) Agriculture, forestry and fishing (N=2) Water supply; sewerage, waste management and remediation activities (N=2) Electricity, gas, steam and air conditioning supply (N=1)
Devolved Government	Public administration and defence; compulsory social security (N=1)
Other	None of the above (N=3)

N=242

Source: Business survey