

How can video support classic sensor data?

SURVEY OF VIDEO USE IN DATA COLLECTION - A REPORT
FROM HBM

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1. Executive summary

HBM conducted a survey with 100 respondents from eight European countries in autumn 2016.

In summary, the survey shows that recording video data in parallel to tactile sensors or digital bus signals is becoming increasingly attractive to users. The format of the recordings can vary from true film to just a snapshot picture, resulting in a true sensor or digital data fusion.

The survey shows:

- **Video use in data collection is relatively widespread.** Almost half of the respondents (47%) already use video in data recording today.
- **Video is most commonly used in structural durability, fatigue testing** (48%). Machine monitoring or general lab testing (30%) and mobile data acquisition or road load data acquisition (28%) are also relatively common areas of application.
- The most common reason for using video in data collection is to gain additional inputs analyzing **unexpected deviations** (73%). Other common reasons are decision finding (50%) and visualization of results for management (41%).
- **Regular video** is by far the most common equipment for video in data collection. In our survey, 80% respondents use such video. High speed video is used by over a third of the respondents (36%), often in combination with traditional video.
- **The survey indicates that use of video in data collection is likely to increase substantially in subsequent years**, which is indicated by both sides: those already using video today and those who are not. In total, 54% respondents expect video use in data collection within their organization to increase. Among non-users it amounts to 37%.
- **Use brings more use:** Those already using video are more prone to increase their usage in subsequent years (76%). None of those already using video expect video usage in general to decrease in the next year.

2. Background

HBM has initiated an online survey to explore the level of use of video recordings in test and measurement and to investigate whether video use will increase. We conducted this survey to find out more about user value, need, preferred solutions and trends. To answer the central question: *How can video support classic sensor data?*

Video cameras are used in many applications throughout the industry. The survey sets out to explore the different applications of video, specifically in the domain of test and measurement.

Based on projects of integrating cameras into real life applications already carried out by HBM together with its customers, we have seen three typical areas of application for video:

- **Vehicle testing**, including applications focusing on:
 - the front view (vehicle path), rear view (follower) or drivers' activity
 - parts under investigation, like steering or axles or tires

- **Lab or bench testing**, focusing on:
 - moving elements in engine/propulsion, gearbox, driveline
 - mechanical structure of coupons, system parts or full-scale products in durability or fatigue testing including crack propagation
 - mechanical structure in impact testing (fall, shock, break, shot) with high speed cameras time synced with tactile sensor information
 - thermal durability testing with infrared (IR) thermal cameras for example in engine testing

- **Infrastructure monitoring**
 - autonomous long term surveillance of infrastructure (bridge, railway wayside, tunnel, building, etc.).

2.1 Methodology

A digital survey was conducted in Q3 and Q4 2016. The respondents were volunteers, accepting to take the survey on HBM's website through a pop-up window, or were recruited through HBM's digital newsletter or in social media posts. As an incentive to take the survey, a draw with a camera as a prize, was conducted among the respondents.

The survey was promoted across Europe, but appeared more frequently on the Nordic HBM websites and in newsletters and social media posts targeting the Nordic market.

Respondents

In total, 100 people took the survey. The majority (69%) work in the Nordic region.

<i>I operate in:</i>	<i>Responses:</i>	
Sweden	35,00%	35
Norway	10,00%	10
Denmark	15,00%	15
Finland	9,00%	9
Germany	3,00%	3
UK	18,00%	18
BeNeLux	6,00%	6
All of Europe	1,00%	1
Other (please specify)	7,00%	7

Total number of respondents: 100

Fig. 1. Break down of respondents by geography. *Total number of respondents: 100*

The most common industries of work for our respondents are Automotive and Machinery (both 15%), followed by Automation/Process Industry (13%). In the category "Other", "Rail" and "Test & Measurement" appeared several times.

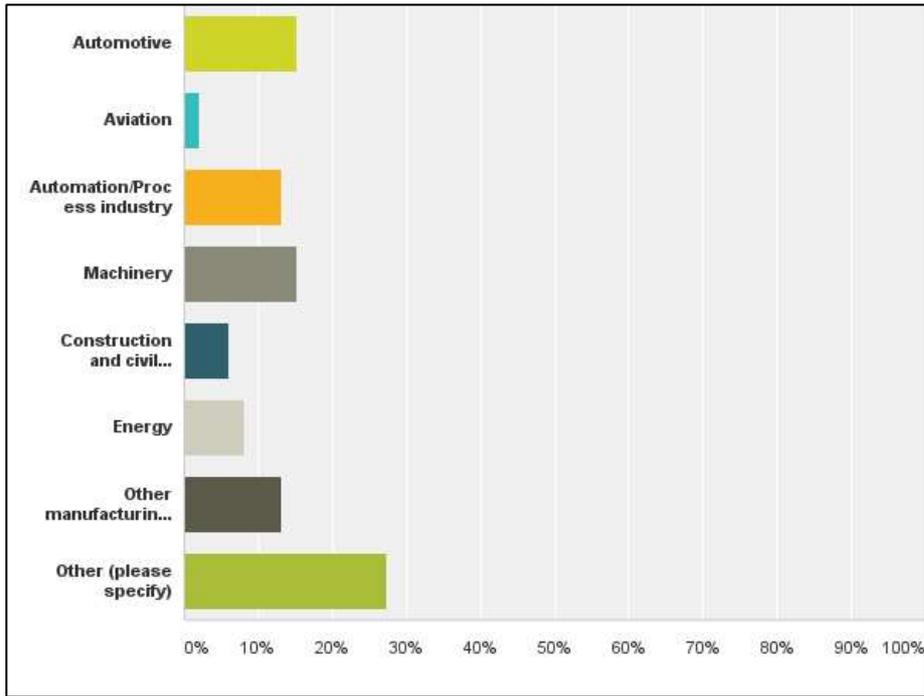


Fig. 2. I am active in the following industry (99 respondents)

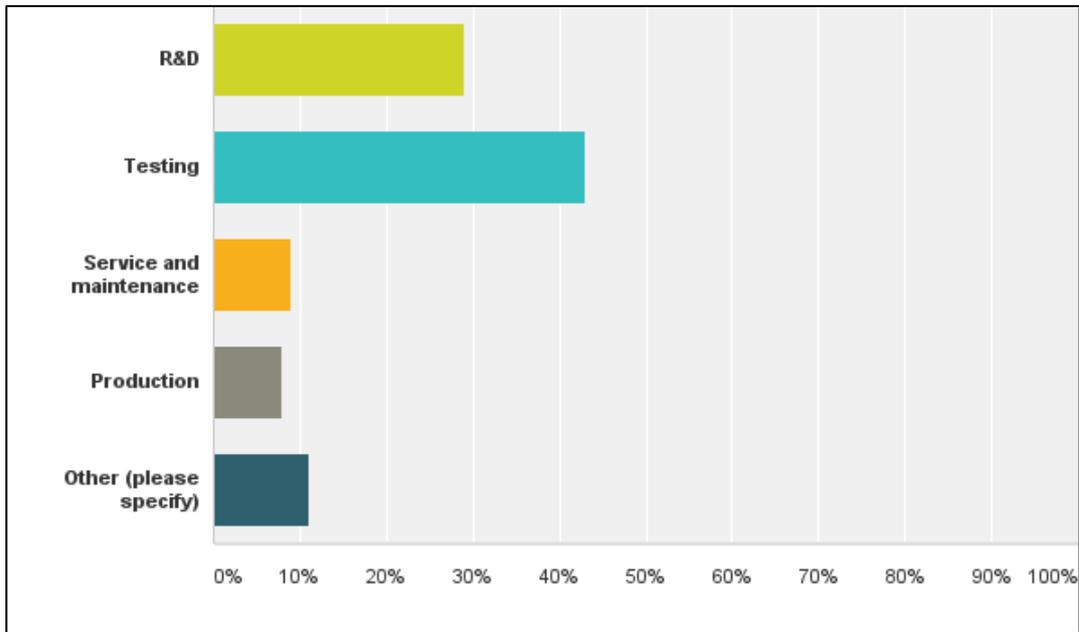


Fig 3. Field of work (100 respondents)

The most common fields of work for our respondents unsurprisingly comprise Research & Development and Testing.

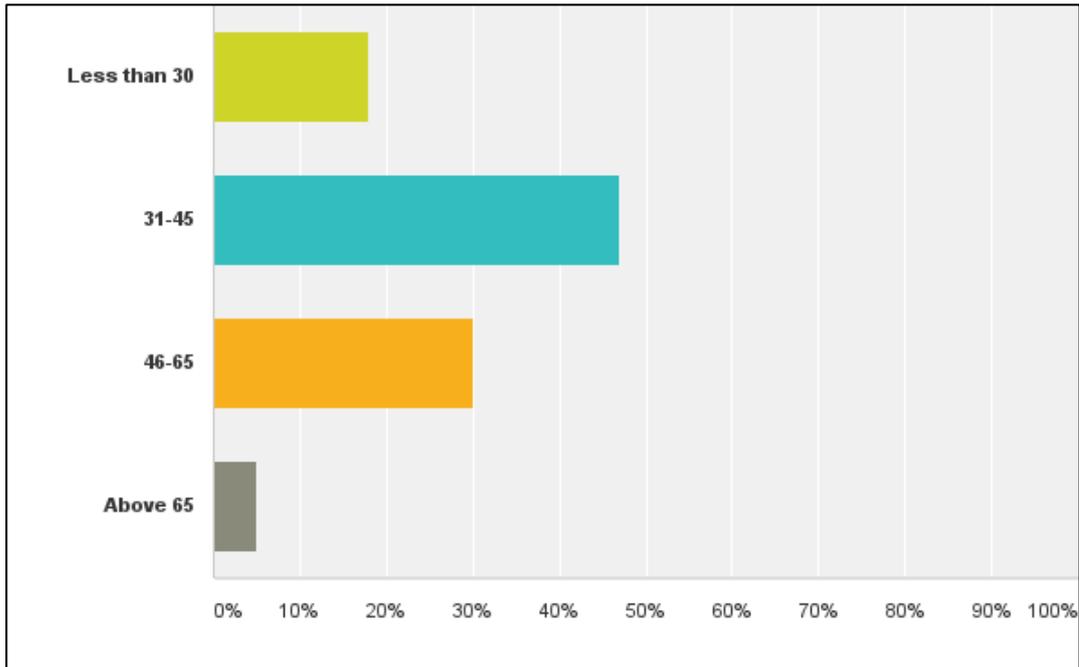


Fig. 4. Age of respondents

Most respondents (47%) are in the age span of 31–45 years followed by 46–65 years (30%).

3. Findings

3.1 Level of video usage today

Around 47% respondents use video in their data recording jobs today.

A comparison shows that video is more common among respondents in Construction & Civil Engineering (67%) and Automotive (57%), than among those operating in the Machinery (46%) and Automation/Process industries (46%).

It is worth pointing out that among those still not using video in data collection, over a third (37%) predict they will start doing so in the next year. Thus, a growing demand of integrating video or pictures in test and measurement applications can be expected.

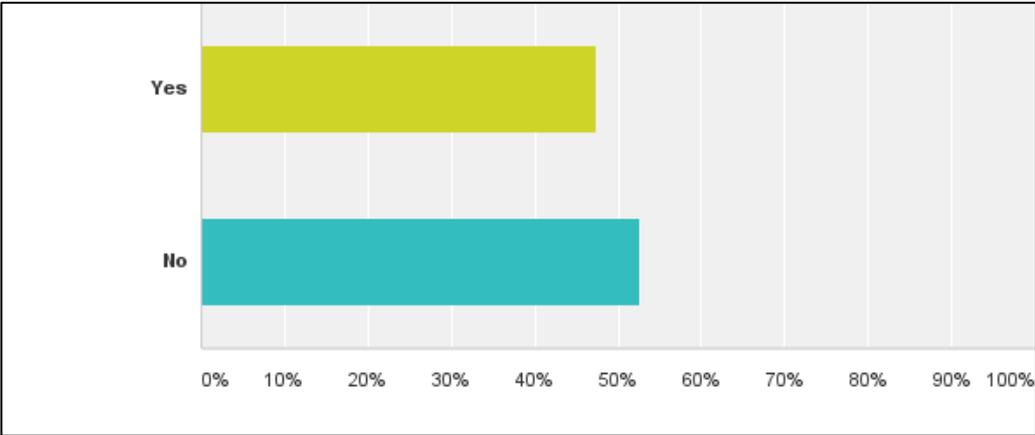


Fig. 5. Today, do you combine data collection with video recording in your measurements?

3.2 Areas of use of video

The respondents using video today (46 responses), most commonly use it for Structural durability, fatigue testing (48%). Other relatively common areas of application are Machine monitoring (30%) and Mobile data acquisition and Road load data acquisition (28%).

In addition to Structural durability, fatigue testing and machine monitoring, respondents in Automotive Industry also use video in crash and impact tests.

Among respondents marking the “Other” option, application areas such as “oil leakage”, “nuclear power safety” and “ship model testing” are mentioned.

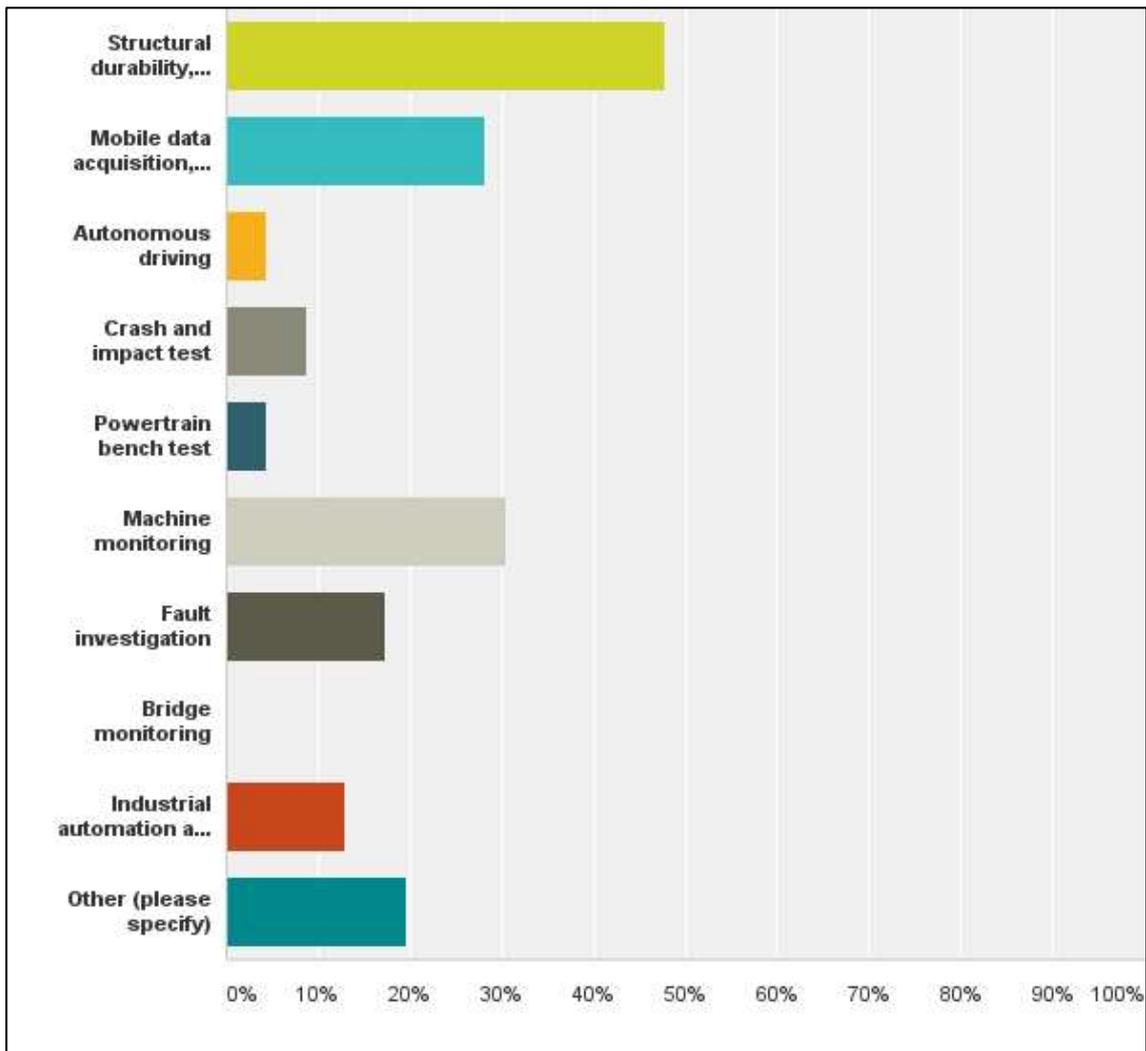


Fig. 6. Within what area do you use video in parallel to analog and digital sensor or bus data?

3.3 Reasons for using video

“Getting additional helpful input to analyze unexpected deviations (i.e. identified truck on bridge as load)” is by far the most common reason for using video in data collection (72%).

Other reasons for choosing a combination of tactile sensor data and video comprise “to be able to interact accordingly based on video analysis (decision finding)” (50%) and “to visualize test and measurement results in an impressive way for management” (41%).

Among those who have chosen the alternative “Other”, reasons which can be summarized as “getting a better understanding” and “showing results to other parties” appear.

In Machinery, it is most common to use video for decision finding (86%). In the Automotive industry, “To get additional input to analyze unexpected deviations” is the most common reason behind video use (75%). The same reason is most popular by respondents in Automation/Process Industry (80%).

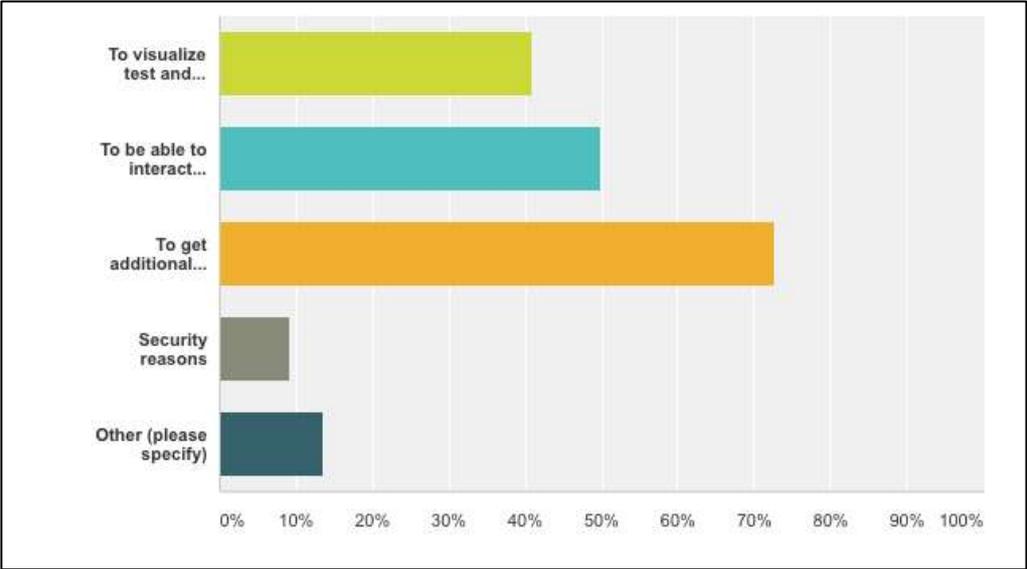


Fig. 7. What is the reason that you have chosen to combine traditional data collection with video?

3.4 Camera equipment

Regular webcams are by far the most common equipment in use. In our survey, 80% respondents use such cost effective cameras. High speed video is used by over a third of respondents (36%), often in combination with traditional video (75%). A couple of the respondents indicate that they use very slow video cameras (slow motion cams like thermal imaging or IR cameras) in their applications.

In our study, high speed video is most common in the Automotive and Machinery industries (19%).

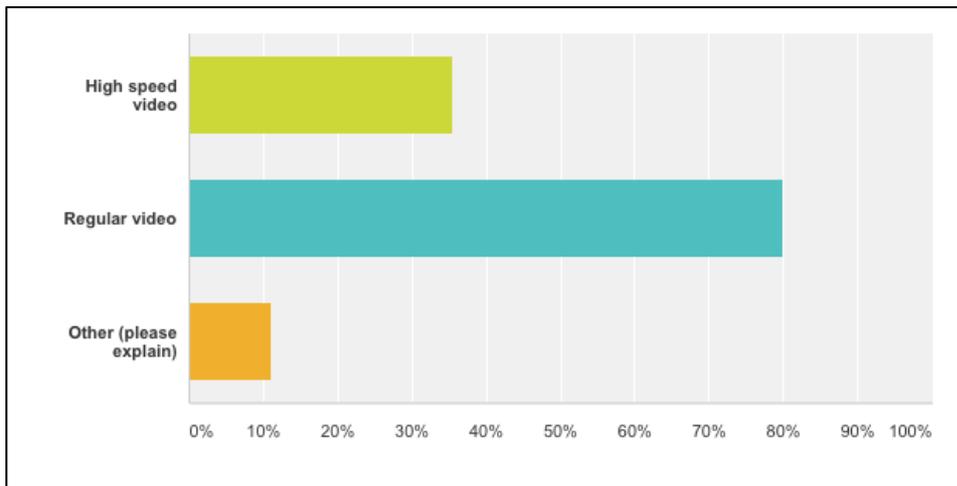


Fig. 8. What type of video camera recording do you use in combination with your data collection?

3.5 Predictions for future use of video in measurement

In total, 54% respondents expect video use to increase, compared to 37% non-users and 76% of those who already use video. Thus, those already using video are more prone to increase their usage in the next year. No respondent expects the video usage to decrease going forward.

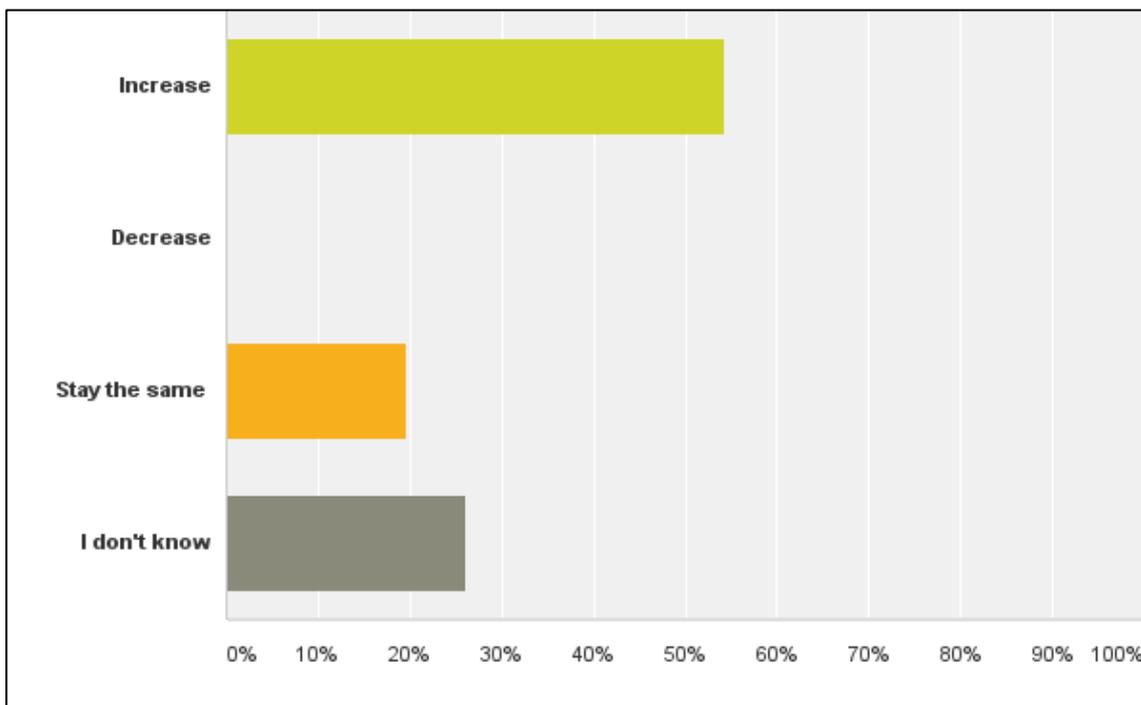


Fig. 7. Is your use of video in data collection expected to increase or decrease in the next year?

Of those 50 respondents expecting to increase their use of video in data, a majority (69%), predict a substantial growth of 10-50%.

The biggest predicted increases can be seen in Automotive Industry, where 22% respondents predict to increase video use with over 50%.

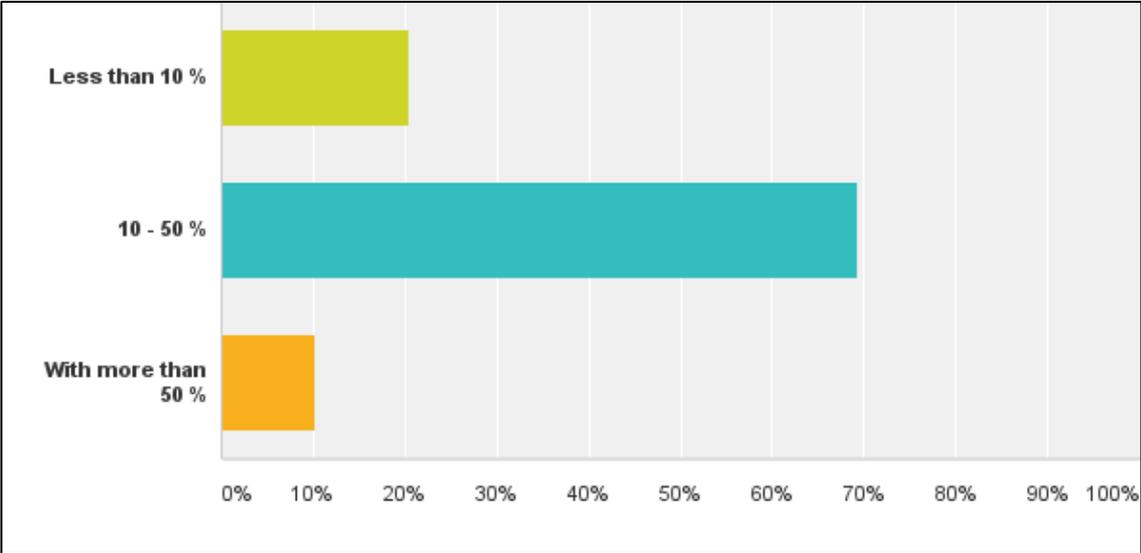


Fig. 8. Approximately how much do you estimate that your use of video in data collection will increase in the next year?

4. Conclusions and outlook

With this survey, we set out to explore the central question: *How can video support traditional sensor data?*

There is no question regarding whether video can support traditional sensor data and be a valuable source of additional information; making room for interpretation even narrower.

Based on the survey, it is fair to say that video is on its way to become an established source of information alongside other sources of data coming from intelligent sensors (radio transmitting/wireless: satellite based, near and wide field radar), tactile or passive transducers or sensors, digital bus signals and calculated real-time data of certain use-case or environmental situations.

HBM already integrates video into a wide range of their applications, which is likely to be more in demand in future. We will see sensors and video integrated together into data acquisition systems (DAQ) in more application areas over time and bring valuable additional insight—not only to the engineers themselves but also to the general public, as our study exemplifies.

Here, an interesting aspect is that video might sometimes be more illustrative than traditional data to target groups including non-engineers. Managers, for example, are normally not in the driver's seat rumbling over bad roads for durability testing purposes. Maximum reliability and robustness need to be validated and stand for the residual value and safety of a vehicle in all conditions. This can be nicely shown in a video, sometimes also for in-house marketing or even for end users.

One thing to bear in mind is that video generates a lot of data. Even an inexpensive and widely accessible webcam produces large amounts of raw data per second. You should ask yourself what is relevant. Too much data might not be needed for the purpose of the particular test, and might only make interpretation and data processing harder. Maybe one single image frame of a bump in the road is enough to explain the deviation you see in traditional sensor data when testing a vehicle?

The survey clearly confirms the need of imagery in addition to classic sensor data. In future, we are likely to see the worlds of video and test and measurement coming together.

We will still need tactile sensors for accuracy, but they can be combined, not only with regular video, but also with stereoscopic cameras, which use images to track and measure a certain position. This future path might reduce the number of sensors needed, but it does not in any way make them redundant.

As tactile and non-tactile worlds of data collection are coming together—there is no question of using either video or traditional sensor data—but of both.