

# The 2020 MEMS industry commercialisation report card

## How the impact of COVID-19 is reflected in the critical success factor grades

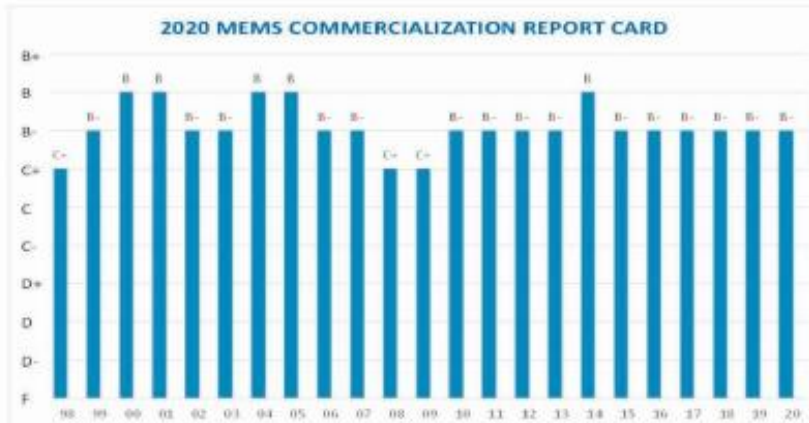
**ROGER H. GRACE,**  
PRESIDENT, ROGER GRACE ASSOCIATES

The results are in and the final grade for the 2020 microelectromechanical systems (MEMS) industry commercialisation report card (report card) is once again B-. However, it is not necessarily the final grade—which has remained the same for six years, thus showing the maturity of the MEMS industry—that is of most interest but rather the change in grades of the 14 critical success factors (from hereon referred to as subjects) comprising the report card. The year 2020 was truly unique in the history of the world and especially regarding the societal and economic changes brought about by COVID-19 (COVID). The MEMS industry has certainly been impacted by this.

regarding their rationale for the grades they provided for each of the 14 subjects, the aim being to illuminate for MEMS industry participants the issues facing successful commercialisation and the strategies for overcoming commercialisation barriers.

### Why the report card?

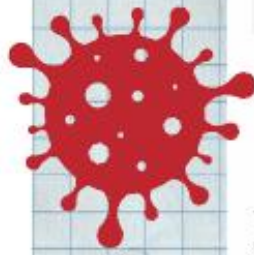
People love to give grades to activities, it is traditional, convenient and objective in nature, and so it is with the grading of the status of the commercialisation success of the MEMS industry. The early intent of the author was to demonstrate to the MEMS community that barriers to commercialisation issues existed in the creation of a successful MEMS



► The MEMS industry commercialisation report card (report card) was created in 1998 and has been published yearly. It has remained at the B- level for the total grade over the past six years, demonstrating the maturity of the MEMS industry. It monitors and reports on the results of a market study that addresses the 14 critical success factors (subjects) for the commercialisation of MEMS for the purpose of assisting MEMS industry participants in optimising their commercialisation success efforts. The standard deviation of the final annual grade from 1998 to 2020 was 0.54. ►

The following paragraphs will address the evolution of the report card, its expected purpose in the successful commercialisation of MEMS and the research methodology from which it has been conducted since its inception in 1998. This article shares the direct responses from the research universe respondents

business and to help guide participants with valuable inputs as to how to better succeed based on past performance. It is noteworthy that MEMS were essentially discovered in the mid-1950s, along with semiconductors, both at Bell Labs.





2020 MEMS COMMERCIALIZATION REPORT CARD INPUT FORM																									
SUBJECT / YEAR	98	99	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Δ	
R&D	A	A	A	A	A	A	A	A	A	A	B+	B	B	B+	B	B	B	B	B	A-	A-	B+	B	-1	
Marketing	C-	C	C+	C+	C+	C	C	C+	C+	C+	C+	C	C	C+	C+	B-	B-	B	B	B	B	B	B	0	
Market Research	C	B-	B-	B-	B	B	B+	B-	B	B	B	B	B	A-	B	B-	B-	C+	C+	B-	B-	B	C+	-1	
Design for Manufacturing	C+	B-	B	B	B	B	B	C+	B-	B	B+	A-	A-	B+	B-	B	B+	A-	A-	A-	B+	B	B	0	
Established Infrastructure	C+	B	B+	A	A	A	A	A	A	A	B+	B+	A	A	A	A	A	A	A	A	A	A	A	B+	-1
Management Expertise	C	C	C+	C+	C+	C+	C+	B-	B-	B	B	B	B	B	B	B	B	B	B	B	B	B	B	0	
Venture Capital Attraction	C	B-	B+	A	C	C	C	C+	C+	C	C	D	D+	D+	D+	D+	D	D	D+	C	C	C	C	+1	
Creation Of Wealth	C	B-	B+	A	C	C	C	C	C	C	D+	C	C+	C+	C+	B-	C+	C+	C+	C+	C+	C+	C+	0	
Profitability	C-	C-	C-	C-	C-	C-	C	C+	C	C	D+	D	C	C	C+	C+	C	C	C	C	C	C	C+	+1	
Industry Roadmap	INC	B-	B	B+	A	A	A	B	B-	C+	C	C	C	C	C	B-	C+	C	C	C	C	C	C	0	
Industry Association	INC	INC	INC	B	B+	B+	B+	B	B	B+	B	B	A-	B+	B+	B+	B+	B+	A-	B+	B	B	B	0	
Standards	INC	INC	INC	INC	C	B-	B-	B-	C+	C	C	C	C+	C	C	C+	B-	C+	C	C	C	C	C	0	
Employment	INC	INC	INC	INC	INC	C	C	C+	C+	C+	C	C	C	C+	C+	C+	B-	B-	B	B	B	B	B	0	
Cluster Development	INC	INC	INC	INC	INC	B	B+	B+	B	B-	C+	C+	C+	C	C+	C+	B-	C+	B-	C+	C+	C+	C+	0	
Overall Grade	C+	B-	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	0	

► While the overall grade of the 2020 MEMS industry commercialisation report card grade remained at B-, there were several changes in the individual grades of the 14 subjects, including venture capital attraction, profitability, infrastructure, R&D and marketing research, many of which had significant attribution to the onset of COVID. The far-right located column with the delta heading provides the change in letter grade from the 2019 level to the 2020 level. ►

According to Gartner, 2020 semiconductor revenue was US\$466.2 billion<sup>1</sup>, but according to IC Insights, 2020 MEMS revenue was \$13.8 billion<sup>2</sup>. This constitutes a greater than 30x ratio. The question is why? Looking to the semiconductor industry and its successful commercialisation is certainly a lessons-learned opportunity. The report card subjects are the vehicles by which this can best be accomplished; and call to actions to provide feedback can be executed to address subjects that appear problematic.

**Methodology**

The report card embraces the classical Delphi method of market research, which uses the inputs of a limited number of highly informed and influential respondents, i.e., market universe in the research universe versus the typically projectionable market research, which is frequently used in determining the projected outcome of elections based on a random sample of the research universe.

For the 2020 report card, 41 completed questionnaires were received from a select list of 75 MEMS industry professionals in the Roger Grace Associates database. The emailed questionnaire required respondents to assign letter grades with pluses and minuses from A to D to each of the 14 subjects as well as provide comments on those that they considered of importance and received the most significant grade changes from the previous year. The typical respondent had an average of 25 years of experience in the MEMS industry and, as such, the report card

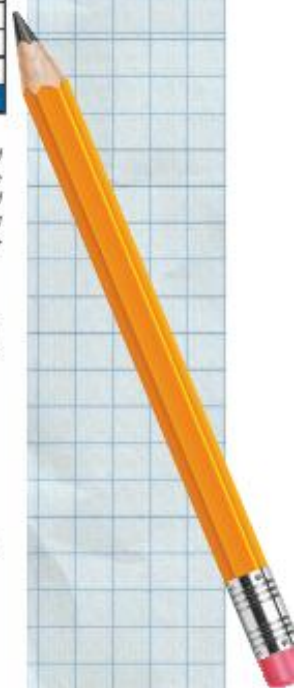
represents a total of over 1,000 person years of experience. To be able to receive a respondent level of participation of more than 50 percent, a series of inquiries were conducted, starting with an initial email call for inputs, followed by two additional email calls. Finally, personal communication was conducted with many of the respondents to specifically address some of their submitted comments. It should be noted that achieving a response rate of over 50 percent for this type of market study is virtually unheard of in the market research community.

**Results**

As previously mentioned, the report card has maintained its B- level since 2014. However, there are a number of important observations and subsequent changes in the grades of individual subjects for this year's report card, which were:

- R&D decreased from B+ to B;
- market research decreased from B- to C+;
- infrastructure decreased from A- to B+;
- profitability increased from C to C+; and
- venture capital (VC) attraction increased from C- to C.

The following text will provide analysis and selected comments from the 41 respondents addressing the subjects. Marketing, despite its grade not changing from the previous year, received a great deal of attention in terms of very different strategies and tactics having to be adopted during COVID.



 article


We, as a MEMS community, need to educate and sell MEMS as the sexiest technology in existence and if we do not, we will be ignored by the public and suffer the consequences."



### Marketing

2019 Grade=B-

2020 Grade= B-

Standard Deviation=1.13

#### Comments

"MEMS have the same old problem, which is that no one knows what MEMS are or what they can do and therefore they do not care."

"We, as a MEMS community, need to educate and sell MEMS as the sexiest technology in existence and if we do not, we will be ignored by the public and suffer the consequences."

"It has been a tough year for marketing as events have been cancelled or become virtual with no in-person meetings, travel etc."

"The restrictions on in-person meetings, travel and attendance at trade shows/conferences has led to an embracing of social media and other communication vehicles to support organisations' marketing efforts."

"Direct mail, e.g., Constant Contact, and webinars/social media have come into play as valuable and cost-effective promotional vehicles."

"What will be the new normal when it comes to MEMS marketing?"

### Infrastructure

2019 Grade=A-

2020 Grade=B+

Standard Deviation=1.10

#### Comments

"We have foundries, yes. Are they state of the art? Increasingly, the answer is no."

"The US government has not supported MEMS infrastructure for many years."

"There is no coordinated effort amongst foundries."

"The MEMS industry did not respond to COVID well. Supply chains were horrible."

"While it is widely publicised that companies are investing, they are investing uniquely in 300 mm. Thus, significant gaps in capacity exist for 200 mm."

"We have developed our own internal infrastructure and try to leverage it as much as possible within our semiconductor business."

"MEMS manufacturing increased in Asia last year with the opening of several large foundries."

"The digitisation of products and production plays an important role for all companies, good MEMS products are no longer enough."

### Market research

2019 Grade=B-

2020 Grade= C+

Standard Deviation=1.11

#### Comments

"Not much change here from the past"

"I still see too many start-ups with unrealistic business plans from a time-to-market and sales volume perspective based on their lack of support for smart market research."

"A reduction in sales and corresponding marketing budgets, including for market research, has eliminated or reduced many programs previously funded."

"Companies were trying to survive and R&D and marketing/market research budgets were considered unnecessary and the first to go."

"MEMS industry management has historically not placed much value on marketing and market research, and it continues to be so."





# CMM

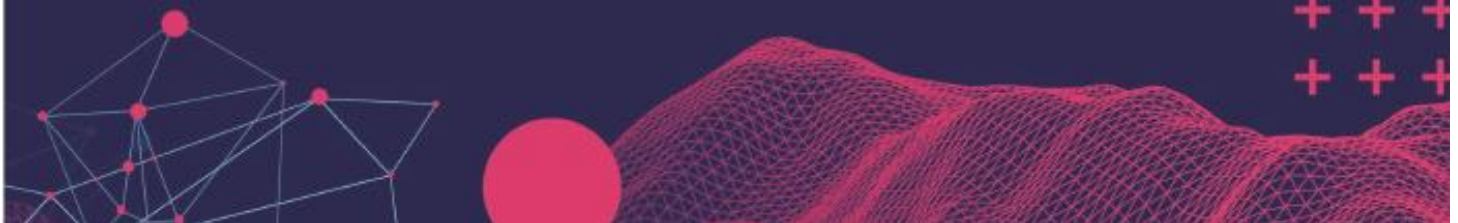
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 a article



## COVID has generated several new product application business opportunities for us.



### Profitability

2019 Grade=C

2020 Grade=C+

Standard Deviation=0.99

#### Comments

"Many MEMS organisations have gone to professional management and were focused on cost reduction over the last few years."

"Big company R&D investments were significantly reduced or eliminated in the short-term and this directly affected the bottom line in a positive sense. The question is, will this affect their long-term success?"

"COVID has generated several new product application business opportunities for us."

"As a result of the reduction in workforce and work-in-place practices, overhead has been reduced, thus increasing profitability."

"COVID gave us an opportunity to eliminate our less-productive workforce."

"The reduction of travel-related business, marketing and market research activities and their associated expenses enhanced our profitability."

"Profitability remains elusive due to continuous commoditisation."




### VC attraction

2019 Grade=C

2020 Grade=C+

Standard Deviation=2.21

#### Comments

"Venture capitalists got interested in MEMS again and this was fuelled, in part, by COVID diagnostics."

"SPAC (special purpose acquisition company)/ IPOs (initial public offerings) enabled several LIDAR technology companies to move forward."

"There has been a growing interest in seed-level investing."

"Government funding of medical devices surged as SPAC/IPOs."

"Large advanced round funding events occurred with Exo Imaging, Butterfly, Vesper (\$8 million), Innovusion (\$60 million) and Barga (\$40 million)."

"Multiple startups were funded, including Hinge Health (\$300 million) and Oura (\$100 million)."

"It continues to be a challenge to compete with software innovation, which have faster time to market as well as higher profitability."

"Successes occur in bringing solutions/products to the market and not just components."

"There is much interest from mainland China venture capitalists, especially for China-based manufacturing."

### R&D

2019 Grade=B+

2020 Grade=B

Standard Deviation=1.16

"R&D infrastructure is extremely strong, especially in universities."

"University R&D will continue to fuel the MEMS market."

"New, young professors are supplementing the experienced ones who helped create this field."

"Exciting work is being done, which will hopefully bring new products to market."



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article **a**

"DARPA (the Defense Advanced Research Projects Agency) lost interest in MEMS several years ago, which set the standard for several other agencies to follow."

"The US needs huge government funding to create a major breakthrough and enable revolutionary research to be performed."

"Perhaps the new administration's apparent interest in funding semiconductors will have a halo effect on MEMS."

"The pandemic was in full force and the disruption at universities seriously affected faculty and student research activities."

"Many foreign students were not able to return to campus, thus negating their efforts."

"Shifting to working at home activities at universities and corporate labs."

"Converting university activities continues to be a challenge for bringing products to market."



**New, young professors are supplementing the experienced ones who helped create this field.**



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**a article**
**Impact of COVID on report card grades**

The many insightful comments provided by the respondents addressed several of these issues from their personal perspectives. Especially affected negatively were R&D, infrastructure and marketing/marketing research. In addition to the subjects addressed in detail, other subjects affected by COVID included employment. Some of the more poignant comments used to summarise the analysis include:

"Working at home negatively affected progress, as did the inability of foreign students to travel to support research at universities." (R&D)

"Elimination of domestic and international travel affected conferences and in-person meetings, although these were somewhat compensated for by virtual events and social media." (Marketing/market research)

"Supply chains were severely challenged and underperformed." (Infrastructure)

"COVID accelerated new investments in biomed and supported later stage commitments." (VC attraction)

"A reduction in workforce, overheads and R&D and marketing budgets increased profitability." (Profitability)

**Summary and conclusions**

The final grade for the 2020 Report Card remained at B-minus with a standard deviation from 1998 to 2020 of 0.54. Changes within the 14 subjects had three subjects decreasing one grade (R&D, infrastructure and market research) and two subjects increasing one grade (VC attraction and profitability).

When reviewing the grades, it was pleasantly surprising to see that marketing maintained its B-minus level. Based on the existence and far-reaching effects of the COVID pandemic for the greater part of 2020, many tradeshow/technical conferences were cancelled and/or went virtual, in-person sales meetings were dramatically reduced and many offices and

manufacturing facilities closed or partially shut down. One would have surmised that this would have had a major negative impact on the grade. However, since MEMS marketers and sales and business development people are a smart and quite resilient lot, it did not. It is likely that they turned to other forms of marketing, much of these being social media-driven, virtual meetings/webinars and direct mail, e.g., Constant Contact<sup>®</sup>. It will be interesting to see what the new normal in marketing will be as the world emerges from the pandemic, especially in the trade show/technical conference arena.

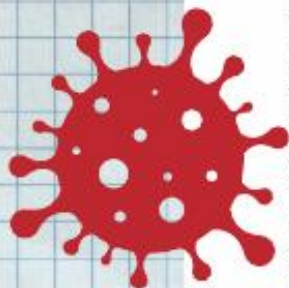


**Elimination of domestic and international travel affected conferences and in-person meetings, although these were somewhat compensated for by virtual events and social media.**



It was not surprising to see the R&D grade fall, since many companies shut down their lab facilities as a result of COVID. Additionally, the loss of sales typically results in a reduction of spending, and R&D and marketing, including market research, are the first to be slashed to maintain profitability.

From a profitability perspective, although many of the respondents interviewed as a follow-up to the email questionnaire (an integral part of the Delphi method) stated that their sales decreased in 2021, it appears that management was quick to cut expenses, including payroll, which more than made up for the loss of sales and thus enhanced profitability. It will be interesting to see if the new 'lean and mean' approach continues.



It appears that the lack of new business opportunities for device manufacturers curtailed spending on bricks and mortar as well as capital equipment, prompting the reduction in grade for the infrastructure subject.

With the recent surge in COVID cases in Q3, 2021, it is likely that the report card for 2021 could be similarly affected as it was for 2020.

It is hoped that the continued development and issuance of the annual MEMS industry commercialisation report card will provide invaluable information and direction to the MEMS industry community, helping it overcome the barriers to commercialisation and continue to formulate strategies and tactics to accomplish this.

The expanded, final report is available on the Roger Grace Associates website.

#### Acknowledgements

The author wishes to thank all the individuals who participated in this research study for their kind, valuable and continued contribution to the MEMS commercialisation community. ●

**Roger Grace Associates**  
[www.rgrace.com](http://www.rgrace.com)

#### References

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